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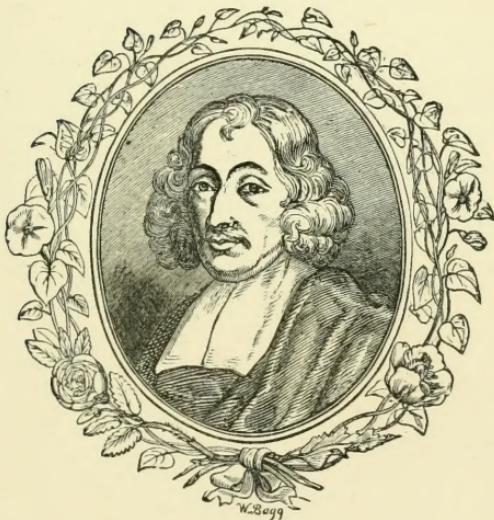
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# BRITISH ORIBATIDÆ.

BY

ALBERT D. MICHAEL,  
MICHAEL,  
F.L.S., F.Z.S., F.R.M.S., &c.

VOL. II.

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## PREFACE TO VOL. II.

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IN the Preface to Vol. I of this book I mentioned the localities in which I myself, or those who had assisted me, had collected *Oribatidae*. Since that time I have searched the following additional localities, viz. the New Forest in Hampshire, Ambleside in Westmoreland, and Keswick in Cumberland. Mr. E. Bostock has collected at Colwyn in Denbighshire, in the Isle of Anglesea, and at other places in North Wales; and Mr. M. J. Michael has collected at Gower in South Wales, at Malvern in Worcestershire, and elsewhere. I am also indebted to the last-named gentleman for the opportunity of examining a collection formed by him in the High Alps.

I have once more to thank all those whose names are mentioned in the Preface to Vol. I for their continued assistance, and especially Prof. T. Rupert Jones for his valuable aid in the laborious work of revising the sheets for the press.

During the year 1886 the sudden death of Mr. Rhein, who engraved all the plates in Vol. I and some of those in the present volume, made it necessary to seek other help in this department; therefore, the greater number of the plates in Vol. II have been placed on the stone by Mr. Horace Knight, on behalf of Messrs. West,

Newman, and Co., and all in the volume have been printed by that firm.

I have little doubt that time will show that this book is not a perfect monograph of the British *Oribatidæ*, therefore I have inserted a list of all original notices with which I am acquainted of species, or supposed species, of *Oribatidæ* not hitherto found in this country ; and I have endeavoured, if possible, to mention some leading characters of the species ; this, I hope, may be useful to anyone finding a species not at present considered to be British. Although subsequent discoveries will doubtless add to our knowledge of the group, I think the book has been prepared carefully, it certainly has been executed to the best of my ability, and I believe that it contains as much information relative to the family as the present state of science respecting the Acarina permits.

ALBERT D. MICHAEL.

CADOGAN MANSIONS,  
SLOANE SQUARE, LONDON ;  
*1st November, 1887.*

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*Amended Table, to assist in the identification of the British species of Tegeocranus.  
Including those discovered since the publication of Vol. I.*

|                                                                                                                                                              |                                                                           |                                                                                                         |                                                                                                                        |                                                                                                                                                               |                                                |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|--|--|--|--|
| Cephalothorax and abdomen sharply divided; interlamellar hairs large and rod-like, markings on notogaster vermiform or coarsely and irregularly reticulated. | Lamellæ undulating blades nearly on edge, or standing free.               | Margin of abdomen different from the centre.                                                            | Lamellæ with a curved outline without points.                                                                          | Lamellæ with a curved outline by a considerable space.                                                                                                        | Lamellæ separated anteriorly by <i>latus</i> . |  |  |  |  |
|                                                                                                                                                              |                                                                           |                                                                                                         |                                                                                                                        |                                                                                                                                                               | Lamellæ joined at their bases.                 |  |  |  |  |
| Form of abdomen broad; hairs bordering it short, fine, and radial or absent.                                                                                 | Lamellæ thick horizontal plates, or triangular ridges; not standing free. | Margin of abdomen not different from the centre. Lamellæ almost straight and rather small.              | Lamellæ with two strong projecting points or angles.                                                                   | Margin of abdomen not clearly divided; markings on notogaster scattered dots; no different margin; no interlamellar hairs; outer layer of cuticle very loose. | <i>cephaliformis</i> .                         |  |  |  |  |
|                                                                                                                                                              |                                                                           |                                                                                                         |                                                                                                                        |                                                                                                                                                               | <i>dentatus</i> .                              |  |  |  |  |
| Markings on notogaster dots arranged in a winding and irregular manner.                                                                                      | Lamellæ thick horizontal plates, or triangular ridges; not standing free. | Notogaster without any different margin.                                                                | Notogaster with a margin different from the centre.                                                                    | Notogaster with a margin different from the centre.                                                                                                           | <i>hericus</i> .                               |  |  |  |  |
|                                                                                                                                                              |                                                                           |                                                                                                         |                                                                                                                        |                                                                                                                                                               | <i>labyrinthicus</i> .                         |  |  |  |  |
| Markings on notogaster long rough bands.                                                                                                                     | Lamellæ with a margin different from the centre.                          | Bands numerous and curved; four rows of spatulate hairs on notogaster; lamellæ thick horizontal plates. | Bands few and broad, almost straight, with undulated sides; no hairs on notogaster; lamellæ massive triangular ridges. | <i>marginatus</i> .                                                                                                                                           | <i>conicus</i> .                               |  |  |  |  |
|                                                                                                                                                              |                                                                           |                                                                                                         |                                                                                                                        |                                                                                                                                                               | <i>femoralis</i> .                             |  |  |  |  |
| Form of abdomen very long; hairs bordering it thick and curved, lying along its edge                                                                         |                                                                           |                                                                                                         |                                                                                                                        |                                                                                                                                                               |                                                |  |  |  |  |
| •      •      •      •      •      •      elongatus.                                                                                                         |                                                                           |                                                                                                         |                                                                                                                        |                                                                                                                                                               |                                                |  |  |  |  |

TEGEOCRANUS DENTATUS,\* sp. nov. Pl. XXVI, figs 1—7  
and fig. 9.

Average length about .80 mm.

Average breadth about .66 mm.

Average length of legs (first, second, and third pairs) about .41 mm.

Average length of legs (fourth pair) about .50 mm.

This species is closely allied to *T. latus*, from which it may be distinguished by the form of the lamellæ, the markings on the abdomen, &c.

**Colour** very dark dull-brown, without any gloss.

**Texture** rough, that of the different parts is described as they occur below.

**Shape** broad and rounded.

**Cephalothorax** pyramidal, or slightly pyriform; smooth, but not polished. Rostrum small, rounded. Rostral hairs small, fine, incurved. *Lamellæ* very large, long blades on edge, near together anteriorly; *upper edge with a blunt point or tooth at the anterior end* bearing the lamellar hair; posterior to this the outline is concave, but rises to a large sharp point or tooth about the middle of the lamella, which is here broader than elsewhere. Behind this point the outline is again concave, but less regularly, and it finishes posteriorly with a rounded convex shoulder just beyond the pseudo-stigma. The lamellæ are lighter in colour than the rest of the cephalothorax: they are clearly reticulated. No true cusps. Lamellar hairs setiform, scarcely curved. Translamella a short thickened bar. Pseudo-stigmata large, open, slightly reniform. Pseudo-stigmatic organs rather long, almost filiform, but slightly increased in thickness toward the distal end, *which is truncated*, and bears two or three minute points. Interlamellar hairs large, rod-like. Tectopedia large, the first pair clearly

\* *Dentatus*, toothed.

reticulated. Opisthophragmatic processes very fine. Sternum only slightly developed.

**Legs** long for the genus ; the femora of the first pair have slender peduncles to suit the deep clefts in which they are inserted ; the other femora pyriform ; genuals of the two front pairs rather longer than usual ; tibiæ slender and clavate. The first pair of legs only have the tactile hair ; tarsi clothed with fine hairs, and there are a few fine, curved hairs, arranged in a whorl, near the distal end of each of the other joints of each leg.

**Abdomen** broad and rounded, scarcely if at all longer than its width ; it is truncated where it joins the cephalothorax, and is there broader than the latter, *from which it is plainly divided*. Notogaster distinctly divided into two regions, viz. a central, and a border, which latter is absent from the progaster ; the border is really double, but the two are not so distinct as in *T. latus*. The central portion is arched, and almost entirely covered by large, very irregular reticulations, with deep pits between them ; the surface of the ridges is granular, and the bottom of the pits finely dotted. Immediately surrounding the central portion is a broad granular band, sloping downward, indistinctly divided into an inner and an outer band. It is simply granular as far as the third pair of legs, after which it begins to be cut into irregular transverse ridges forming strongly marked projecting points round the lateral and hind margins. There are about a dozen very fine, short, white hairs round the inner edge of the border. Genital and anal plates pentagonal, near together ; whole ventral surface rough.

### *Larva and Nymph.*

These are so like the corresponding stages of *T. latus* that I do not propose to redescribe them ; the only difference being that the great, curved, serrated

spines on the abdomen are longer in the present species than in *T. latus*, and that the brown, trifid projections round the margin of the abdomen of the nymph have an extra brown point just at the insertion of the spine, which is absent from those of the nymph of *T. latus* (see fig. 9).

**Distribution.**—Species generally distributed, not uncommon ; found in decayed stumps of trees and fallen branches in woods, &c., with *T. latus*, for which it may easily be mistaken.

### TEGEOCRANUS CEPHEIFORMIS,\* Nic. Pl. XXV, figs. 1—7.

*Tegeocranus cepheiformis*, Nic. P. 465, pl. ix, fig. 1.

— — — Michael. Abh. d. Naturw. Ver. zu  
Bremen, Mai, 1885, pp. 207  
—213.

Average length about .62 mm.

Average breadth about .43 mm.

Average length of legs (first pair) about .31 mm.

Average length of legs (second pair) about .28 mm.

Average length of legs (third pair) about .34 mm.

Average length of legs (fourth pair) about .37 mm.

This very interesting species was first discovered and named by Nicolet, who, however, states that it is identical with Koch's *Cepheus latus*; had it been so Nicolet's name could not have stood. Relying on Nicolet's statement, I, in the first volume of this book, treated his name as a synonym of Koch's species.† Since the publication of that volume I have discovered Nicolet's species in England and traced its life-history ; and I find that, although the imagos of the two are very similar, yet they present certain small but constant differences, and the two creatures in their immature stages are quite unlike. Therefore Nicolet's

\* *Cepheus*, the genus of that name (*Oribatidæ*) ; *forma*, a shape or likeness.

† Vol. i, p. 310.

name must stand. The adult may be known from *T. latus* by its smaller size, and the form of the lamellæ.

**Colour** very dark, dull-brown without any gloss.

**Texture** rough, almost the whole dorsal surface cut into deep, vermiform corrugations.

**Shape** broad and rounded.

**Cephalothorax** pyramidal, or slightly pyriform. Rostrum small, rounded, *but from the dorsal aspect the rostrum is hidden by the lamellæ*, which are very large long blades more or less on edge, with a sinuated upper outline ; they *almost (or at their bases quite) join anteriorly*, leaving a thin straight line between them, like a knife-cut, instead of a considerable space which allows the point of the rostrum to be seen, as is the case in *T. latus*. The lamellæ are lighter in colour than the rest of the cephalothorax, and are clearly reticulated. Lamellar hairs fine and curved, springing from small indentations ; *no cusps* to the lamellæ. No space for any translamella. Pseudo-stigmata large, open, slightly reniform, light in colour. Pseudo-stigmatic organs of moderate length, clavate, but rather longer and more bluntly ended than those of *T. latus* ; somewhat recurved. Interlamellar hairs thick and near together. Tectopedia large, clearly seen from the dorsal aspect. Sternum fairly well marked.

**Legs** rather long for the genus. The femora of the first pair have slender peduncles to suit the deep clefts in which they are inserted ; the other femora are pyriform. The genua of the two front pairs are rather longer than is usual in the genus ; tibiæ slender and clavate. The first pair of legs have the tactile hairs, and there are a few other fine hairs arranged in a whorl near the distal end of each other joint, except the tarsus of each leg. Tarsi clothed with fine hairs in the usual manner.

**Abdomen** broad ; somewhat square in its posterior outline ; truncated where it joins the cephalothorax, *from which it is plainly divided*. Notogaster distinctly marked out into two regions, a central portion and a

border, which, however, is absent from the progaster ; the central part is much arched, and almost entirely covered by short, irregular, vermiform, anastomosing ridges ; and these form an irregular reticulation, with shallow, depressed spaces between them ; both ridges and spaces are rough and somewhat granular. The border is flatter than the central region, but slopes downward ; it is rough and irregular, its anterior portion is strongly granular ; the remaining part bears large, transverse, irregular ridges or corrugations which project beyond the lateral edges, giving a very broken outline. There are not any hairs on the notogaster, and only a few very short ones round the posterior margin.

Genital and anal plates pentagonal, near together. Whole ventral surface rough.

### *Nymph.*

This creature, which has been discovered since the publication of the first volume of this book, is certainly one of the most singular and beautiful creatures in the whole range of the *Oribatidæ*.

**Colour** light-brown or drab, legs and rostrum darker and with a slightly redder shade.

**Texture** rough, granular, sometimes almost glittering, as though strewn with specks of mica ; on a careful microscopical examination this effect is found to be due to a sort of areolation, or pitting.

**Form** elliptical ; the ellipse becomes broader at each ecdysis. The periphery, between the projections mentioned below, is rough and broken by granulations.

**Cephalothorax** small, conical. Rostrum blunt. Ros- tral hairs leaf-like, similar to those hereinafter de- scribed as bordering the abdomen, but straight, and devoid of the singular projection from which each abdominal hair springs. Pseudo-stigmata dorsal, pro- jecting, cup-like. Pseudo-stigmatic organs long, rough.

stiff spines ; slightly thickened at the ends. There is a small, straight spine (possibly the interlamellar hair) on the dorso-vertex just inside each pseudo-stigma ; and a rather longer, rough spine outside. The dorso-vertex also bears two patches of singular granular markings, which look like internal organs imperfectly seen through the chitin.

**Legs** short, the hind pair not reaching the posterior margin ; of about even thickness throughout, but the joints nodose and very rough and irregular in form. The tactile hairs are setiform, large and long on the two front pairs of legs. Almost every joint of each leg has a whorl of large hairs or spines, of which those on the outer sides of the tibiæ and genua are mostly more or less leaf-like or serrated, particularly on the two hind pairs of legs. Most of the other hairs on the legs, except those on the tarsi, are spinous or serrated ; the tarsal hairs are setiform, but are very thick and strong, particularly on the first two pairs of legs ; most of the whorl-hairs spring from chitinous papillæ.

**Abdomen** elliptical, dorsal surface flattish at the edges, but the central part, which is in fact the larval cast-skin, is considerably raised, the highest part being the longitudinal median line, so that the skin is formed somewhat like a ridge-roof, and to this ridge the abdomen slopes up from all sides ; but the larval skin slopes more rapidly than the others. The ventral surface is arched, so that the notogaster is considerably higher in level than the cephalothorax. The cast notogastral skins are carried, the larval forming a central elliptical shield, and the nymphal skins appearing as concentric rings bordering it. The margin of the larval skin turns in slightly ; round it are a series of rough, spinulated spines, mostly curved, and directed backward and slightly outward, except those on the anterior margin, which are directed forward ; all these spines have a slight tendency to a leaf-like formation ; and there are three pairs of similar spines, rather more

leaf-like, arranged longitudinally in the median line of this skin. Round the lateral and posterior margins of each nymphal skin are a series of sixteen (or fourteen in some young skins) large, flat, chitinous, brown projections of very singular form; each corresponds bilaterally with its fellow on the opposite side of the body, but no two pairs are alike. All, except the hind pair, are comparatively narrow where they spring from the abdomen, but each expands suddenly to a head, which is trifid in the hind pair, the central cusp being the smallest. As the projections get further forward they lose their trifid form, the central cusp coalescing more and more with the anterior, and the posterior cusp becoming larger and more elongated, until the projection at the antero-lateral angle is reached, which again is trifid like the posterior. From the central cusp of each of the hind and anterior projections, and from the portion of the coalesced anterior and central cusps which represents the central in the other projections, springs a strong spine, which is straight in one or two cases, but generally singly or doubly curved. Each spine is bordered on each side by a broad, thin, transparent membrane, or chitinous expansion, which follows the line of the spine and is supported by it, and which is elegant and sweeping in curvature, broadest about the middle or near the proximal end, and pointed at the distal end, giving the whole structure a leaf-like appearance, the spine being the mid-rib of the leaf. This effect is increased by a number of spinules which spring from the central spine and extend sometimes to the edge of, or slightly beyond, the membranous expansion; or sometimes stop a little short. The central spine, and some of the spinules, bear short sharp thorns or spikes pointing in various directions, but chiefly upward. The projections are radial from the abdomen, but the leaf-like processes are not; the hind pair are in the line of the projections, and point backward; those further forward are set at various angles to the projections from

which they respectively spring and point outward and backward. One of these projections, with its leaf-like process, is figured in Plate XXVI, fig. 11. Near the middle of the anterior margin of the abdomen, and of each cast-skin, is a pair of strong spines, slightly spinulated, bearing very narrow membranes, and springing from small trifid projections ; between these and the antero-lateral projection on the same side, is a very small bifid projection bearing a rough, slightly leaf-like spine pointing inward and forward. The genital and anal plates are small and elliptical ; the whole ventral surface corrugated and dotted.

**Distribution.**—The species as yet has, I believe, only been found at three places in England, viz. the New Forest, Gomshall in Surrey, and near Stone in Staffordshire ; but, doubtless, it might be found elsewhere by proper search. It was recorded first by Nicolet in France, and the nymph was first found by Herr S. A. Poppe near Bremen ; he however did not succeed in tracing what species it belonged to ; and this was not ascertained until I found the species at Gomshall and succeeded in dissecting the imago fully formed out of the body of the inert nymph. I have since bred it frequently. Both nymph and adult inhabit fir-trees, and are found among the fallen needles and on the bark, particularly fallen bark. The adult may be beaten off the trees ; it is not uncommon at the New Forest, but seems to be capriciously distributed there, being very local.

Professor Berlese, in his ‘Acari, &c., Italiani,’ fasc. xxxiii (October, 1886), has figured and described what he calls *Tegeocranus cepheiformis*, Nic. The description would not, I think, be sufficient to enable anyone to distinguish between two or three allied species, but the plate is certainly not drawn from *T. cepheiformis*. It may possibly be drawn from *T. latus*, Koch, but the sharp anterior angles of the lamellæ which he draws are not found in either species, and the markings on

the notogaster are not like *T. latus*; possibly it may be some separate species more allied to *T. dentatus*. There appears to be some accidental miscarriage or confusion in this plate and description, as his figure 3 does not agree with his figures 1 and 2, and he inserts, among his references for synonymy, my descriptions both of *T. latus*,\* and of *T. cepheiformis*,† which he could hardly have done intentionally, supposing him to have read the latter paper.

**TEGEOCRANUS HERICIUS,‡ sp. nov.** Pl. XXV, figs. 8—13; Pl. XXVI, fig. 10.

Average length about .59 mm.

Average breadth about .42 mm.

Average length of legs (first pair) about .30 mm.

Average length of legs (second and third pairs) about .27 mm.

Average length of legs (fourth pair) about .34 mm.

This handsome species often has dirt adhering to it.

**Colour** very dull, dark, yellow-brown.

**Texture** extremely rough.

**Shape** pyriform.

**Cephalothorax** long and rather narrow, conical. Dorso-vertex reticulated. Rostrum small, rather pointed, but not sharply so. Rostral hairs largish, curved, set far back. Lamellæ long, *nearly straight*, reticulated blades on edge; not so large as those of *T. latus*, *T. dentatus*, &c.; near together anteriorly; no cusps. Lamellar hairs thick, directed forward. Translamella inconspicuous. Pseudo-stigmata dorsal,

\* "A Contribution to the Knowledge of British Oribatidæ," 'Journ. Roy. Micr. Soc.,' ser. i, vol. ii, p. 247.

† See heading of this description.

‡ *Hericius*, an old Latin form of the word "Erinaceus" vel *Herinaceus*, a hedgehog. The French word, "Herrisé," bristling, probably has this root; and it is possible that the local Somerset expression, "Herrish," stubble, may have come from the same source.

not large; pseudo-stigmatic organs almost upright, with peduncles of moderate length, and large, shortly pyriform, rough heads. Interlamellar hairs rod-like, somewhat curved. Tectopedia very large and prominent, particularly the first pair. Opisthophragmatic processes very small.

**Legs** of moderate length, the fourth pair slightly passing the posterior margin. Femora of the first pair with slender peduncles, genua of two front pairs rather long. Tactile hairs on first pair of legs only; tarsi with the usual fine hairs, other joints with a few curved hairs.

**Abdomen** oval; progaster rounded and distinct. The whole edge, except the progaster, is broken up by very strong, rough projections *bearing stout sharply-curved hairs*. Thenotogaster is not mucharched, and the edge is slightly curved upward, but the *ornamentation is the same over the whole notogaster, there not being any different band round the edge*. This ornamentation consists in a number of very strong, rough ridges forming a coarse and very irregular reticulation, with remarkably deep pits between the ridges; the bottom of these pits is granular. Reticulations average about forty to the millimètre. Genital and anal plates near together, the former square, the latter pentagonal.

### *Nymph.*

This is a very beautiful and extremely elaborated creature (in external appearance), in fact one of the most so in the family.

**Colour** light whitish-brown or drab; legs and rostrum slightly darker reddish-brown.

**Shape** elliptical; the ellipse becomes broader at each change of skin; the edge is rough and broken by granulations.

**Cephalothorax** small, conical. Rostrum blunt. Ros-tral hairs fine; on the dorso-vertex are some ridges

forming almost a square, and having an oblique ridge running from each posterior angle of the square to the pseudo-stigma on the same side. These ridges undoubtedly represent the lamellæ and translamella of the adult. From the anterior angles of the square spring the lamellar hairs, which are strong serrated spines. Pseudo-stigmata rather dorsal. Pseudo-stigmatic organs longish, with rod-like peduncles and almost fusiform heads. Interlamellar hairs very strong serrated spines.

**Legs** short, of about even thickness throughout; joints rough and irregular in form. Each of the three central joints of the two front pairs of legs bears a whorl of large, serrated, curved spines, those on the outside of the legs being the largest. The two hind pairs of legs bear similar spines, but smaller. Tactile hairs on first pair of legs very long.

**Abdomen** elliptical, or almost round; the central part more or less raised. Ventral surface arched, so that the notogaster stands much above the cephalothorax. The cast notogastral larval and nymphal skins are carried on the back, where the larval forms a central shield, and the nymphal concentric rings bordering it. The larval skin is slightly wrinkled, and bears ten large, deeply-serrated, curved, blunt spines round its edge, directed outward and backward, and five pairs of similar spines forming two longitudinal lines very near together, one on each side of the median line. Round the margin of each nymphal skin are about twenty large, flat, chitinised projections (see Pl. XXVI, fig. 10), of which two pairs are on the progaster, and one on the antero-lateral angle; of these three pairs the second is small and scarcely more than bifid, the two others are trifid, like the projections from the nymph of *T. latus*. In the projections further back, the two lateral lobes, instead of being entire, split dichotomously into two sharp, flat, diverging spikes; this is hardly indicated in the posterior pair of projections, and the central lobe, just before the insertion of

the undermentioned spine, gives off a single similar spike, but smaller, just as is the case in the nymph of *T. dentatus*. From the central lobe of each projection springs a very long and large spine; those on the first (or central) pair of projections on the progaster are deeply serrated, or slightly spinulated, and curve forward and somewhat outward; those on the second pair are straight, slightly spinulated, and directed obliquely forward and inward; those on the antero-lateral angles are directed forward and outward, and bear numerous pairs or whorls of long sharp spinules, which diminish gradually in size; those near the proximal end of the principal spine being much longer than those at the distal end; the former have a decided tendency to be recurved. The spines on the projections further back are mostly doubly curved (line-of-beauty-shaped), are directed backward and outward, and have spinules similar to those last described. The posterior pair of spines curve backward. The ventral surface is rough and lined, the genital and anal plates almost touch.

**Distribution.**—This species has hitherto only been found (by myself) at the New Forest, near Lyndhurst, on oak-trees.

GENUS—NOTASPIS,\* *Hermann.*

Equals *Belba*, Heyden?

Equals parts of *Oribates*, *Zetes*, *Oppia*, and *Eremæus*, Koch.

Equals *Notaspis*, Nicolet.

Equals *Oppia*, Canestrini and Fanzago.

Equals *Oppia*, Berlese.

*Apterogasterinæ* with cephalothorax ankylosed to abdomen, with lamellæ, and with the second, third, and

\* Νοτος, a back; ασπις, a shield.

fourth pairs of legs articulated at the edge of the body.

This genus was originally instituted by Hermann, but in his work it practically includes the whole family; the restriction of it to the sense employed in this book is due to Nicolet, who, however, was only acquainted with a small number of the species.

I am aware that I am differing from several acarologists in considering the *Belba* of Heyden to represent this genus; I have therefore placed a ? to draw attention to it. *Belba* has generally been taken to refer to *Damaeus*, Koch; I fail, however, to see the grounds for this supposition. *Belba* is founded upon the type of *Notaspis corynopus*, Hermann. On reference to Hermann's work it will be found that his description of that species is very short, and that, short as it is, it includes a manifest error, the tarsi being described as chelate. But I think that anyone referring to Hermann's figure must see that it is intended for a *Notaspis*, in the sense used by Nicolet and in this book, and is not a *Damaeus*.

This genus, although Nicolet was not fortunate in finding them, appears in England to include more species than any other in the *Apterogasterinæ*, and some of these species, e. g. *N. lucorum*, are as abundant in number of individuals as any of the *Oribatidæ*. The terrestrial species are usually very active and many are highly polished; others finely or coarsely punctured or pitted; but I am not acquainted with any that are really rough or have other distinct patterns on the notogaster, as in *Tegeocranus*, &c.

The genus naturally divides itself into two groups, the tridactyle and the monodactyle; the latter are mostly considerably smaller than the former, *N. similis* being rather an exception; *N. lacustris* is also exceptional, but the aquatic species of *Oribatidæ* usually are so. Nicolet treats *N. bipilis* as the type, and as he only knew of three species he was probably right in doing

so ; it is, however, a very extreme species, and in my opinion a species such as *N. lucorum* would make a better type.

**Rostrum** usually more or less pointed, occasionally very sharply so, as in *N. bipilis* (Pl. XXVII, fig. 1). The genæ do not usually form distinct lobes. The rostral hairs are generally fine and curved.

The **Labium** usually does not cover more than half the opening of the camerastomum ; it is generally as broad as or broader than long (Pl. XXVII, fig. 3 ; Pl. XXIX, fig. 3 ; Pl. XXXIII, fig. 12) ; it usually has a rounded posterior and a truncated anterior margin.

**Palpi** usually rather filiform, no joint being specially enlarged (Pl. XXVII, fig. 5). The first joint is short, as usual ; the second is very long, almost as long as the remaining three ; the third and fourth short ; the fifth rather long.

**Maxillæ** usually well developed, ordinarily bilobed, sometimes with a sharp inner tooth between the lobes (*N. tibialis*), sometimes more complex (Pl. XXXIII, fig. 3).

**Mandibles** of the ordinary form, each limb usually tridentate or quadridentate.

**Lingua** well seen in dissections of many species.

**Pseudo-stigmata** sometimes rather dorsal, sometimes almost hidden by the edge of the abdomen ; usually they are small but distinct ; in the single aquatic species they are scarcely visible from the exterior ; this is the rule rather than the exception with aquatic species.

**Tectopedia** moderately well developed in many species, especially the first and second tectopedia, but they do not run up the side of the body as in *Oribata*, &c. ; in some species they are very small.

**Opisthophragmatic processes** very small or entirely absent ; the median process is not present in any species which I know of.

**Legs** usually of moderate length ; the joints, except the coxæ, somewhat clavate. The femora of the two front pairs of legs are usually enlarged ; the femora

and coxæ of the two hind pairs are enlarged but flattened internally so as to slip along the sides of the abdomen. The first pair of femora are usually more or less pedunculate, and all are often provided with blades (Pl. XXVII, figs. 8, 9; Pl. XXIX, figs. 8, 14, &c.). The genuals are usually small; the tibiæ, particularly those of the two hind pairs of legs, often long and slender (Pl. XXIX, figs. 1, 11); those of the front legs are sometimes almost globular, with short peduncles (*N. monilipes*, *N. splendens*, &c.). Nicolet, judging from the three species which he knew, considered that all members of the genus had tridactyle and homodactyle claws; a wider knowledge shows that some species are monodactyle and some tridactyle; and that of the latter some are homodactyle and some heterodactyle. According to Nicolet's view this would probably have necessitated the creation of two new genera, but, as before stated, I am not able to coincide in this.

**Notogaster** generally much arched, rarely with any marking beside the dotting or pitting; it is almost always furnished with two rows and a border of hairs; these may be exceedingly fine and small (Pl. XXXIII, fig. 10; Pl. XXXII, figs. 7, 12), or may be large and setiform (Pl. XXIX, fig. 11), or may be large and serrated (Pl. XXIX, fig. 1).

**Genital and Anal Plates.**—These vary considerably in different species both in size and position; in some the plates are small and at opposite extremities of the ventral plate (*N. bipilis* Pl. XXVII, fig. 3; *N. splendens*, Pl. XXXIII, fig. 12, &c.). Sometimes they are much larger and closer together (*N. serrata*, Pl. XXIX, fig. 3, &c.). Sometimes they may occupy almost the entire length of the ventral plate and be close together (*N. lanceolata*, &c.).

The **Tracheal system** is fully developed.

The **Cæca** of the ventriculus are usually short and round.

The **Ovipositor** is extremely long, with the cusps long and delicate, and the corrugations beautifully fine

and regular (Pl. G, fig. 11, which, however, is not on a sufficiently large scale to show the corrugations).

The adults of this genus are found chiefly in moss and lichen, many species being almost confined to the latter, but some species are to be found in various materials.

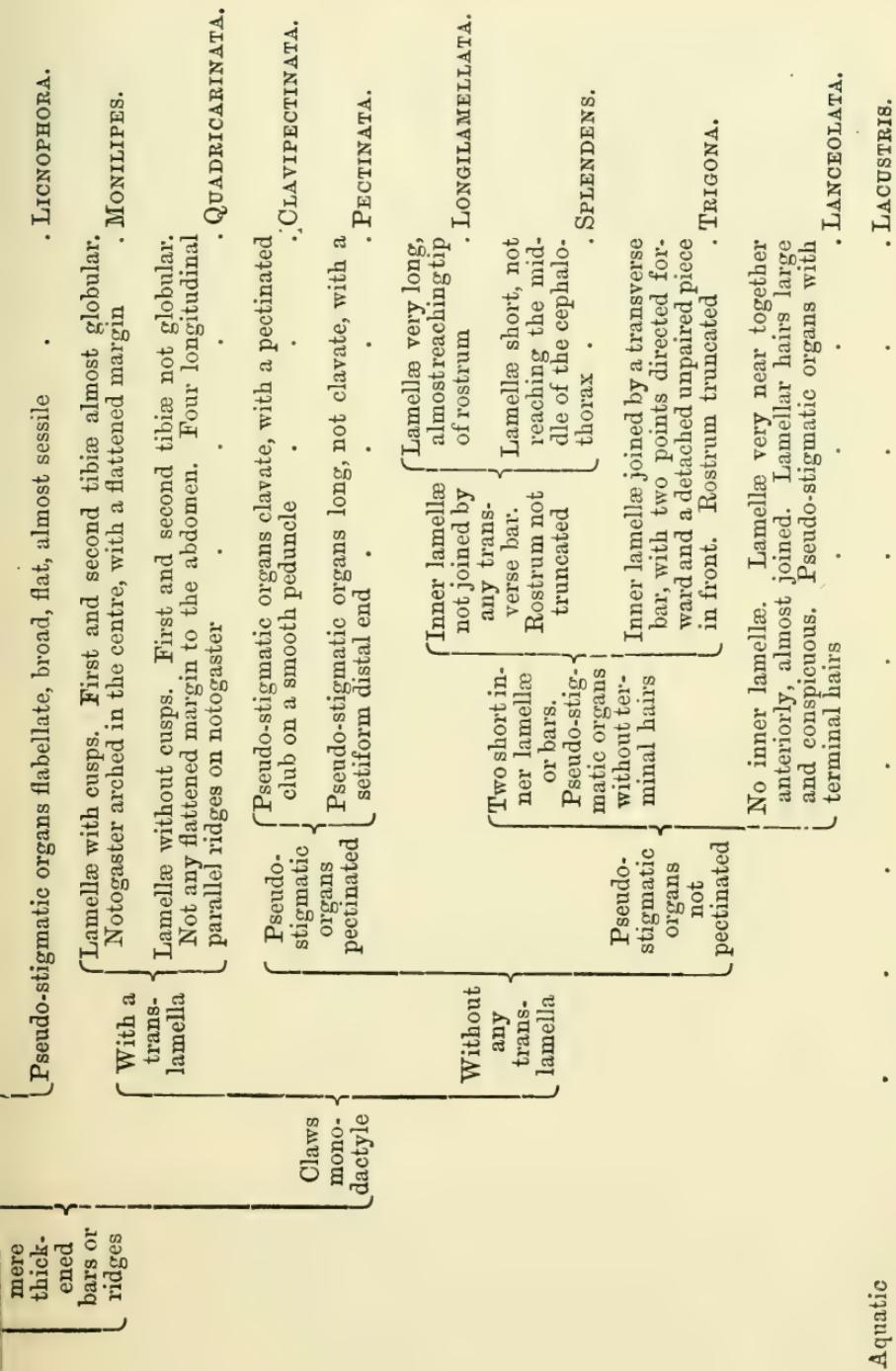
The larvæ and nymphs of many species have a considerable resemblance to the adults and might probably be supposed to be the immature stages (*N. serrata*) ; others are not unlike, although wanting in the minute details which distinguish the species of the adults. Finally there are larvæ and nymphs which are very different from the imagos (*N. bipilis*, *N. lacustris*, *N. oblonga*).

The genus is probably most nearly allied to *Damæus* ; in some species as *N. monilipes*, *N. splendens*, the clavate or moniliform shape of the joints of the legs, so characteristic of the last-named genus, is very marked. In some species the projecting antero-lateral corners of the abdomen seem like the rudiments of pteromorphæ ; thus the resemblance of *N. tibialis* to *Oribata Lucasii* is striking.

*N. bipilis* and *N. monilipes* must be considered as extreme species at the different ends of a series. A great number of the minute monodactyle species appear at first hopelessly alike, but a little practice will enable the student to distinguish them without difficulty, when he can see them clearly under a sufficient amplification, say 150 to 200 diameters.

Table to assist in identification of British species of *Notaspis*.

|                           |                                                                                       |                                                                                                                                                                                                                                                   |            |
|---------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Claws<br>tridac-<br>tyle  | Lamellæ<br>with<br>cusps                                                              | Cusps extremely long. Pseudo-stigmatic organs long, serrated spines. A large serrated spine on the coxa of the third leg                                                                                                                          | BRIILIS.   |
|                           | Lamellæ<br>without<br>cusps                                                           | Cusps short. Pseudo-stigmatic organs short, pyriform, not serrated. Not any spine on the coxa of the third leg                                                                                                                                    | EXLIS.     |
| Claws<br>mono-<br>dactyle | Lamellæ<br>blades<br>on edge                                                          | Lamellæ without cusps. Pseudo-stigmatic organs with slender peduncles and recurved, fusiform heads                                                                                                                                                | TIBITALIS. |
|                           | Lamellæ<br>separated                                                                  | Lamellæ and pseudo-stigmatic organs as in <i>tibialis</i> , the former widely separated                                                                                                                                                           | SMILIS.    |
| Claws<br>tridac-<br>tyle  | Lamellæ<br>almost<br>meeting                                                          | Lamellæ almost meeting anteriorly, and with long cusps                                                                                                                                                                                            | JUNCTA.    |
|                           | Hairs on notogaster strongly serrated                                                 | Hairs on notogaster strongly serrated                                                                                                                                                                                                             | SERRATA.   |
| Claws<br>tridac-<br>tyle  | Pseudo-<br>stigmatic<br>organs,<br>with<br>globular,<br>fusiform,<br>or pyri-<br>form | Interlamellar hairs longer than pseudo-stigmatic organs. Claws almost homodactyle. A spine standing outward on each antero-lateral angle of the abdomen. Lamella springing from pseudo-stigmata, and much wider apart posteriorly than anteriorly | PILOSA.    |
|                           | Hairs on<br>notoga-<br>ster not<br>serrated                                           | Hairs on notogaster peduncles                                                                                                                                                                                                                     | TERESTRIAL |
|                           | Lamellæ                                                                               | Interlamellar hairs shorter than pseudo-stigmatic organs. Claws strongly heterodactyle. No spines on antero-lateral angles of the abdomen. Lamellæ parallel, and not springing from the pseudo-stigmata                                           | OB LONGA.  |



Aquatic

## NOTASPIS BIPILIS,\* Herm. Pl. XXVII.

- Notaspis bipilis*, Hermann. P. 95.  
 — — Nicolet. P. 448.  
 — — Berlese. Acarofauna Sicula.  
*Oribata* — Gervais. Vol. iii, p. 259.  
*Oppia cornuta*, Koch. Heft 38, fig. 8.  
 — *bipilis*. Can. e. Fan., p. 20.  
*Oribates badius*, ? Koch. Heft 30, fig. 23.  
*Oppia badia*, ? — Uebersicht, p. 105.  
*Murcia acuminata*, — Heft 31, fig. 24 (Nymph).

Average length about .65 mm.

Average breadth about .42 mm.

Average length of first pair of legs about .38 mm.

Average length of second pair of legs about .31 mm.

Average length of third pair of legs about .42 mm.

Average length of fourth pair of legs about .48 mm.

This is a very handsome and remarkably active species ; it is, moreover, perfectly distinct from any other British species, and cannot be mistaken.

**Colour** reddish-brown, not very dark.

**Texture** highly polished, reflecting exterior objects like a mirror.

**Cephalothorax** in some respects exceptional. Rostrum long and attenuated and ending in a very sharp point ; there is a smaller point from the gena, on each side, and further back three or four small serrations along the lower edge of the gena. Towards the centre the cephalothorax is arched. The dorso-vertex is polished like the rest of the upper surface. Lamellæ nearly on edge ; each has a blunt point running inward at the anterior edge of the dorso-vertex ; beyond this the cusps of the lamellæ are continued nearly as far as the point of the rostrum, and stand quite free in air ; they are narrow, fine, curve very slightly, and end in a sharp point above with a very small square shoulder below it, from which springs a strongly

\* *Bis*, twice ; *pilus*, hair.

serrated spine (the lamellar hair) directed straight forward. The rostral hairs, which are set on slight protuberances, are large and strong. Pseudo-stigmatic organs long, straight, strongly serrated spines, directed almost transversely, but slightly inclined forward. The interlamellar hairs are enormous, being great, serrated, straight spines directed forward, outward, and upward, almost reaching the point of the rostrum. The tecto-pedal ridges are very strong and the cavities to receive the first pair of legs very large.

**Legs** long and thin ; the femora of the first two pairs are very fine towards the proximal extremity, swelling suddenly a little before the centre ; the hind femora have blades. The tibiæ of all the legs have much the same formation. There are tactile hairs on all the legs, those on the first pair being very long. There is a remarkably long, strong, straight, serrated spine on the coxa of each leg of the third pair near the proximal end, at the outer corner : this spine usually stands more or less parallel to the pseudo-stigmatic organ, and it is from these two spines on each side that the name is given. There are two or three pairs of short, curved, serrated spines on each tarsus and one pair on each other joint ; all the tarsi are densely clothed with long fine hairs.

**Abdomen** circular and arched ; it bears two pairs of large, straight, serrated spines, one pair on the hind margin and the other pair a little within the margin ; four shorter hairs on the ventral surface just show from the dorsal aspect. Genital and anal plates small and far apart.

### *Nymph.*

This very handsome nymph was, as above stated, known to Koch, but was treated by him as a distinct species and called *Murcia acuminata*.

**Colour** translucent white passing into light tints of yellow and grey ; some specimens are wholly

yellowish. The anterior part of the rostrum and the whole of the legs are light reddish or pinkish. The internal organs show distinctly through the notogaster, making patches of colour. The two preventricular glands are usually very plainly seen but not always so ; between them the ventriculus and the intestinal canal form a large patch of colour, which is most often one or more shades of yellow-brown, and more or less saddle- or bag-shaped, but it varies greatly both in colour and form.

**Cephalothorax** usually about one-third of the entire length. Rostrum pointed, but the point is far more obtuse than in the adult. It is conical with rather curved sides and a slight shoulder bearing a second pair of rostral hairs, the first being near the tip. Behind the rostrum the cephalothorax widens considerably, but continues more or less conical, and is deeply excavated for the insertion of both the first and the second pairs of legs. There are usually two short, curved, longitudinal ridges, with their convex sides inward, on the pro-vertex ; and two larger, parallel, transverse ridges, with the convex sides forward, just in front of the pseudo-stigmata ; these markings, however, vary a little and are often irregular. The pseudo-stigmata are rather close together on the dorsal surface and a good deal raised. Pseudo-stigmatic organs long, filiform, and recurved.

**Legs** nearly but not quite as long in proportion as those of the adult, but thicker and of more uniform thickness throughout ; somewhat rough. There are tactile hairs on first pair of legs only, but these attain a remarkable size, being longer than the whole leg itself. All the tarsi are thickly set with fine hairs, and there is a pair of short curved hairs on each of the other joints of each leg except the coxæ.

**Abdomen** ovate, truncated anteriorly, and having two papilla-like processes projecting from the anterior margin between the pseudo-stigmata ; it also has two large papillæ nearly close together, forming a projection

in the centre of the posterior margin, and having a shorter rounded papilla filling up the space between them. From each of the two lateral papillæ springs a hair of extraordinary size, being fully as long as the whole body of the creature, and pointing backward and somewhat upward ; these hairs assume all sorts of curves. The notogaster has a polished surface, but it is closely dotted all over with minute punctures ; it does not bear any hairs.

During the inert stage the membrane which unites the cephalothorax and abdomen is drawn out, the two central anterior papillæ coalescing and apparently over-hanging the cephalothorax ; the markings then mostly disappear and the abdomen becomes flask- or gourd-shaped.

**Distribution.**—The species is generally distributed, and is found in moss most frequently on the ground. It has been recorded in France, Germany, Italy, and Switzerland.

NOTASPIS EXILIS,\* *Nic.* Pl. XXVIII, figs. 1—5.

*Notaspis exilis*, Nic. P. 448, pl. iii, fig. 7.

— Haller. P. 305.

*Oppia exilis*. Can. e. Fan., p. 21.

Average length about .37 mm.

Average breadth about .19 mm.

Average length of legs (first pair) about .18 mm.

Average length of legs (second pair) about .17 mm.

Average length of legs (third pair) about .15 mm.

Average length of legs (fourth pair) about .20 mm.

It is often difficult to distinguish this species from *N. tibialis*, especially as both species vary considerably. This is a very active creature.

**Colour** light yellow-brown.

\* *Exilis*, thin, slender.

**Texture** polished, but when seen by a sufficiently high amplification *very* finely punctured. The chitin is thin and semi-transparent, showing the internal organs through the dorsal surface, particularly in summer.

**Cephalothorax** rather small, not very clearly marked off from the abdomen. Rostrum round-pointed, slightly trifid. Rostral hairs tolerably large and curved, but often almost hidden by the lamellar hairs. Palpi usually showing more or less. *Lamellæ long blades on edge broader at the distal than the proximal ends*; cusps short, longer in some specimens than in others. Lamellar hairs long, setiform, directed forward almost horizontally, springing from near, but not quite at, the upper angles of the anterior ends of the lamellæ. Translamella a mere thickened line. Pseudo-stigmata almost hidden by the advancing corners of the abdomen. Pseudo-stigmatic organs with *short peduncles and pyriform heads*, which vary in the extent of the bluntness of the larger ends. The heads appear very granular or cellular internally, and have a few very minute points at the extreme end externally. Interlamellar hairs long, setiform. First and second tectopedia well developed.

**Legs** of moderate length, the front pair being rather longer in proportion than the hinder pairs; blades of the femora small or absent (first pair). Each anterior tibia has an elevation at the distal end of the median line from which the tactile hair springs. *Claws tridactyle*, very heterodactyle. Tactile hairs to all the legs; most joints bear one or two thickened hairs near the distal extremity and some fine hairs, but both of these are frequently missing; tarsi thickly clothed as usual.

**Abdomen** longer than broad, somewhat rounded posteriorly. Progaster strongly undulated, being deeply indented above the pseudo-stigmata. The *antero-lateral angles of the abdomen project more suddenly than in N. tibialis but not quite so much*; the pro-

jection finishes posteriorly with a sharper shoulder, and is not carried so far back. There is a row of very fine curved hairs round the margin, and two longitudinal rows of similar hairs on the notogaster. Genital and anal plates at opposite extremities of the sternal plate; the former smallish and pentagonal with the point forward, the latter large and almost square.

*Nymph.*

A very active creature.

**Colour.**—Abdomen and hinder part of cephalothorax almost colourless, but with a slight grey or yellowish tinge; the creature being, however, very transparent, the internal organs are seen through the dorsal surface, and thus colour is given, usually yellow or green. Rostrum and legs pink or reddish.

**Texture** highly polished.

**Cephalothorax** without markings, palpi generally showing. Rostral hairs more conspicuous than those of the adult. Pseudo-stigmatic organs similar to those of adult.

**Legs** of about the same comparative length as those of the adult. Tactile hairs long on all the legs; most joints have a whorl of fine curved hairs.

**Abdomen** similar to that of the adult in most respects except colour and texture, but the progaster is an even curve, not indented; the antero-lateral angles do not project, but they each bear a hair or spine stronger and longer than the others on the abdomen, and standing transversely outward; all the hairs on the abdomen are more conspicuous than those on that of the adult, but still small.

**Distribution.**—Generally distributed, chiefly found in moss; and principally in spring and summer. The species has been recorded in France, Germany, and Italy.

NOTASPIS TIBIALIS,\* Nic. Pl. XXVIII, figs. 6—8.

*Notaspis tibialis*, Nic. P. 449, pl. iii, fig. 8.  
— — — Haller. P. 305.

Average length about .48 mm.

Average breadth about .29 mm.

Average length of legs (first pair) about .20 mm.

Average length of legs (second pair) about .16 mm.

Average length of legs (third pair) about .18 mm.

Average length of legs (fourth pair) about .22 mm.

This species resembles the last; it is very active.

**Colour** bright chestnut-brown.

**Texture** polished in appearance, really *very* finely punctured.

**Cephalothorax** rather small and not very clearly marked off from the abdomen. Rostrum round-pointed, slightly trifid; rostral hairs large and curved, set far back. *Lamellæ long blades on edge, narrower at the distal than the proximal ends; no cusps; translamella a mere line, not conspicuous.* Lamellar hairs rather long, setiform, directed forward almost horizontally. Pseudo-stigmata hidden by the advancing corners of the abdomen. Pseudo-stigmatic organs with *slender peduncles of moderate length and recurved fusiform heads roughened with minute points.* Interlamellar hairs very long, setiform, rough, almost perpendicular. Tectopedia well developed. Apodemata joined to the sternum.

**Legs** rather short, fourth pair not reaching the hind margin. Femora with blades; each front tibia has a large rounded elevation in the anterior end of the median line from which the tactile hair springs. Claws *tridactyle*, strongly heterodactyle. Tactile hairs to all the legs; most joints bear one or two thickened spine-like hairs near the distal extremity, and some fine hairs; tarsi thickly clothed as usual.

**Abdomen** longer than broad, rounded posteriorly,

\* *Tibia*, the shank.

progaster undulated, but not so strongly as in *N. exilis*. The antero-lateral corners project very much but do not stand out so sharply or suddenly as in *N. exilis*; the projection is carried further back. There is a row of very fine curved hairs round the margin, and two rows of similar hairs on the notogaster. Genital and anal plates at opposite extremities of the sternal plate; the former small, pentagonal with the point forward; the latter large and almost square.

### *Nymph.*

I have bred this species, but it is so extremely difficult to distinguish the nymph from that of *N. exilis* that I refrain from describing it as I did not succeed in breeding the actual specimen which I had drawn and described.

**Distribution.**—Generally distributed; chiefly found in moss and dead leaves; it has been recorded in France and Germany.

NOTASPIS SIMILIS,\* sp. nov. Pl. XXXI, figs. 9—12.

Average length about ·55 mm.

Average breadth about ·33 mm.

Average length of legs (first pair) about ·22 mm.

Average length of legs (second pair) about ·19 mm.

Average length of legs (third pair) about ·17 mm.

Average length of legs (fourth pair) about ·25 mm.

I doubt whether it would be possible to distinguish this species from *N. tibialis* were it not for the monodactyle claw, although *similis* is usually a trifle larger (but they both vary considerably in size), and it has a more marked undulation below the antero-lateral corner of the abdomen.

\* *Similis*, like.

**Colour** bright chestnut-brown.

**Texture** polished in appearance, really very finely punctured.

**Cephalothorax** rather small and not very clearly marked off from the abdomen. Rostrum rather small-pointed but not sharp; slightly trifid. Rostral hairs large, curved, set far back. Lamellæ long narrow blades on edge, narrower at the distal than the proximal ends; no cusps. Translamella a mere line, not conspicuous. Lamellar hairs rather long, setiform, directed forward almost horizontally. Pseudo-stigmata hidden by the advancing corners of the abdomen. Pseudo-stigmatic organs with slender peduncles of moderate length and more or less recurved fusiform heads. Inter-lamellar hairs very long, setiform, almost perpendicular. Tectopedia well developed. Apodemata joined to the sternum.

**Legs** rather short, fourth pair not reaching the hind margin. Femora with blades; each front tibia has a large rounded elevation in the anterior end of the median line from which the tactile hair springs. *Claws monodactyle*. Tactile hairs to all the legs; most joints bear a whorl of slightly thickened or fine curved hairs near the distal extremity, tarsi thickly clothed as usual.

**Abdomen** rather long, not very round posteriorly; progaster very slightly undulated; the antero-lateral angles project very much and are rounded; there is an inward (concave) curve behind them, and then they are carried back and fade into the notogaster. Notogaster plain, without markings, but with a row of very fine hairs near the margin, and two longitudinal rows of similar hairs nearer the median line. Genital and anal plates at opposite extremities of the ventral plate, the former small, pentagonal, with the point forward; the latter large and almost square.

**Distribution.**—Generally distributed, chiefly found in dead leaves and moss; it has doubtless usually been mistaken for *N. tibialis*.

I found two specimens at the New Forest rather shorter and much narrower than those above described ; their pseudo-stigmatic organs have rather longer peduncles and larger heads ; they probably are a separate species, at present I treat them as a variety.

NOTASPIS JUNCTA,\* *Michael.* Plate XXVIII, figs.  
9—12.

*Notaspis juncta*, Michael. Journ. Roy. Microsc. Soc., ser. ii, vol. v,  
p. 385.

Average length about .22 mm.

Average breadth about .13 mm.

Average length of legs (first pair) about .12 mm.

Average length of legs (second and third pairs) about .11 mm.

Average length of legs (fourth pair) about .15 mm.

A minute species, chiefly remarkable for the lamellæ meeting in the middle of the cephalothorax, and for the long, closely-approximated cusps of the lamellæ.

**Colour** rather light yellow-brown.

**Texture** polished, without any markings or punctures that are visible with, say, 200 diameters amplification.

**Shape** short-pyriform.

**Cephalothorax** conical with rounded sides. Rostrum pointed ; rostral hairs nearly straight. Palpi slightly porrected. Lamellæ *thin blades almost on edge*, which, although widely separated at their posterior ends, *approach so close together anteriorly that they actually touch* in the median line at about the centre of the cephalothorax ; they are slightly undulated. The cusps are very long, and where they start from the lamellæ rise with a rounded shoulder ; they twist over so as to become almost horizontal, and diminish, with curved sides, to a blunt point. The lamellar hairs are terminal, long, straight, and directed forward. Pseudo-stigmata almost hidden by the abdomen and lamellæ,

\* *Junctus*, joined.

pseudo-stigmatic organs rather short, with slender peduncles extending only slightly beyond the pseudo-stigmata, and rather long fusiform heads, which form a slight angle with the peduncles. Interlamellar hairs absent or rudimentary. First tectopedia mere ridges, second tectopedia curved blades well developed. Lateral opisthophragmatic processes well marked, no central process. Apodemata joined to the sternum.

**Legs** rather short, the hind pair only slightly passing the posterior margin. Femora very broad, thin, and rounded, with large blades. Tibiæ much enlarged towards their distal ends, which are considerably larger than the proximal ends of the tarsi; there are a few fine hairs on each joint. Claws *monodactyle*.

**Abdomen** a very short ellipse, almost globular, progaster slightly truncated; at each antero-lateral angle of the notogaster, immediately behind the pseudo-stigma, is a blade-like projection with an undulated lateral, and a square posterior edge. There are a few short fine hairs round the posterior margins. Genital and anal plates rather large, roundish, and near together.

**Distribution.**—I have found the species chiefly in moss on trees at Epping Forest; it is not common.

#### NOTASPIS SERRATA,\* *Michael.* Plate XXIX, figs. 1—10.

*Notaspis serrata*, Michael. Journ. Roy. Microsc. Soc., ser. ii, vol. v, p. 389.

Average length about .56 mm.

Average breadth about .37 mm.

Average length of first pair of legs about .30 mm.

Average length of second and third pairs of legs about .28 mm.

Average length of fourth pair of legs about .34 mm.

A medium-sized species, chiefly characterised by

\* *Serratus, serrated.*

the extreme length and roughness of the hairs on the notogaster, and by being usually covered with fragments of lichen, &c., and by what looks like a coner-void growth.

**Colour** dull, darkish brown.

**Texture** coarsely pitted with circular or subcircular areolations, entirely without polish. The whole creature covered with short villous processes.

**Form** pyriform; posterior margin very round.

**Cephalothorax.**—Rostrum narrow but rather rounded; rostral hairs curved and pectinated. Cephalothorax long, thick (from sternal to dorsal surfaces); the posterior part narrow dorsally, but wider below; decidedly constricted before joining the progaster. No lamellæ or translamella; the lamellar hairs, however, persist (on the dorso-vertex) and are curved inward and serrated. Pseudo-stigmata near together, very dorsal, strongly projecting. Pseudo-stigmatic organs of medium length, with fine peduncles and short pyriform or almost globular heads. Interlamellar hairs long, flexible, pectinated. First tectopodium small and round, second and third conspicuous. No opisthophragmatic processes. Apodemata reaching the sternum.

**Legs** moderately long; femora large and rounded, the two front pairs with thin proximal ends, which, however, are short. Tarsi almost elliptical, but with long peduncles bearing the claws, which are tridactyle. Tactile hairs small. There are the following curved, pectinated hairs on the legs, viz. a whorl of three or four on each of the three central joints of each leg of the first or second pairs; one hair on each coxa and tibia, and a whorl on each femur and genual of the third and fourth pairs. All the tarsi are clothed with stout, setiform hairs.

**Abdomen** oval. Notogaster coarsely pitted; very narrow at the progaster, and there the notogastral plate does not cover any part of the side of the abdomen, but broad posteriorly, and there turned under so as to form the whole posterior, and part of the ventral skeleton.

There is a somewhat irregular row of very long, flexible, serrated hairs round the margin of the notogaster, and two rows of about three similar hairs rather nearer to the median line. Ventral plate small, truncated anteriorly, where it is widest; rounded and narrow posteriorly, where it bears three pairs of serrated hairs. Genital and anal plates large; the former almost square, the latter diamond-shaped. Ovipositor short for the genus.

*Nymph.*

The usual appearance of this nymph is of an irregular lump of small pieces of lichen, white powder, and other débris, from which springs a forest of long, serrated hairs, standing out on every side far beyond the body.

**Colour** pale fawn or mouse colour, but little of the true tint is seen, however, the cuticle being in most instances chiefly concealed by the quantity of the above-named materials which adhere to it, and to the long hairs.

**Texture** rough and leathery.

**Shape** almost oblong.

**Cephalothorax** distinctly divided into two parts, the rostrum being much narrower than the hinder portion, which is almost as wide as the abdomen. Rostral hairs large, serrated, curving strongly inward, the two usually crossing in front of the rostrum. Pseudostigmatic organs rather dorsal, of moderate length, with short pyriform heads on filiform peduncles. Interlamellar hairs long, thick, strongly serrated, and standing nearly upright.

**Legs** short, the fourth pair scarcely reaching the hind margin; they are inserted near together and are thick; the femora of the two front pairs are considerably enlarged. The tactile hairs are large on all the legs, and there is a whorl of stout, strongly-curved, serrated hairs on each of the three central joints of each leg. The tarsi have fine hairs as usual.

**Abdomen** not much arched, nearly parallel-sided. Progaster slightly rounded, and raised above the cephalothorax. Posterior margin rounded and depressed, sometimes with a tendency to a median indentation. The whole outline of the abdomen is, or appears, rough and irregular, from the texture and shrivelling of the skins, and the foreign matter which adheres to them. The cast notogastral skins are carried on the back, flat and concentrically, but shrivelled and so hidden by débris, &c., that they often are only noticed in consequence of the serrated hairs which border them. The central (larval) skin shows an indication of fine, transverse, irregular corrugations. Each skin is bordered by a closely-set row of long serrated hairs, which stand outward and backward from their respective insertions, and curve strongly upward and inward at their distal ends; those on the outer skin are usually far the longest. If the specimen be well preserved and has not been disturbed, these hairs stand in concentric rings, the outer ring projecting far beyond the body; if, however, the nymph has been rubbed or wetted, the hairs get into confusion, and appear to be a mere tangled bunch, without arrangement; those on the larval skin are usually chiefly rubbed off.

**Distribution.**—I have found the species in Hopwas Wood (Warwickshire), and more abundantly at Ambleside (Westmoreland) and Keswick (Cumberland). Mr. Bostock has found it at Stone (Staffordshire) and Colwyn (North Wales). It is usually among lichen on walls, in rather dry places. It is not common.

## NOTASPIST PILOSA\* (Koch), Pl. XXIX, figs. 11—16.

*Zetes pilosus*, Koch. Heft 31, pl. xii.

— *pilosulus*, — Uebersicht, Heft 3, p. 101.

Average length about .45 mm.

Average breadth about .30 mm.

Average length of legs (first and second pairs) about .23 mm.

Average length of legs (third pair) about .26 mm.

Average length of legs (fourth pair) about .30 mm.

This species may be noticed by the length of the setiform hairs on the notogaster, and by its colour.

**Colour** bright, *very red-brown*.

**Texture** polished.

**Cephalothorax** conical in general form, but with an undulated outline. The rostrum rather blunt, and curved outward until near the middle of the cephalothorax, thence the central part of the cephalothorax is raised and runs straight back, increasing but little in width; the lateral part, however, is depressed, and increases suddenly and rapidly, forming a kind of broad shelf, which supports the two front pairs of legs (the engraver who reproduced my drawings has not made this clear enough). Rostral hairs thick and curved. Palpi and mandibles (which latter are large) usually showing. *Lamellæ very short, slightly-raised, nearly straight ridges, nearer together at their distal than at their proximal ends.* *Lamellar hairs long, upright, serrated.* No translamella. Pseudo-stigmata at the very base of the cephalothorax, almost under the edge of the abdomen. Pseudo-stigmatic organs rather long, standing upward, outward, and slightly backward; they have filiform peduncles and rough, gradually clavate (or spatulate) heads, with rounded distal ends, which in many positions look fusiform. Interlamellar hairs long, much longer than the pseudo-stigmatic organs, up-

\* *Pilosus*, hairy.

right, serrated. First apodemata not joined to the sternum.

**Legs** rather long, extending considerably beyond the hind margin. First and second femora large, the latter with blades. Claws powerful, *tridactyle*. Tactile hairs on all legs. There are about two thick, curved, setiform hairs near the distal end of each joint; two or three further back on each femur of the two front pairs; one on each hind coxa, and a few other similar hairs. The tarsi are thickly set with fine hairs.

**Abdomen** short, pyriform; hinder end broad and rounded, but with a very slight indication of a point. *A strong spike stands horizontally outward* (nearly at right angles to the median line of the body) from the very edge of the abdomen between the second and third pairs of legs. There are two longitudinal rows of about four *extremely long*, curved, setiform hairs near the median line of the notogaster, and a row of similar hairs round the periphery, a little within the actual edge. These hairs are about half as long as the abdomen. Genital and anal plates far apart, nearly square, the latter much the larger.

I am not acquainted with the immature stages of this species.

**Distribution.**—I have found one or two specimens at Epping Forest, the New Forest, and the Land's End, Cornwall. It appears to be scarce.

NOTASPIS LUCORUM,\* (*Koch*). Pl. XXX, figs. 1—5.

*Type species.*

*Zetes lucorum*, Koch. Heft 31, pl. xiii.

Average length about .67 mm.

Average breadth about .37 mm.

Average length of legs (first and second pairs) about .30 mm.

\* *Lucus*, a grove of trees sacred).

Average length of legs (third pair) about .36 mm.  
Average length of legs (fourth pair) about .42 mm.

This is a particularly active species.

**Colour** rather yellowish-brown of a medium shade, almost even over the whole creature.

**Texture** polished, but finely punctured; punctures about 120 to the millimètre.

**Cephalothorax** conical, with a slightly rounded and trifid rostrum; the central portion of the cephalothorax is considerably arched, leaving a depressed lateral shelf at the hinder part which supports the first pair of legs. The raised portion of the cephalothorax is slightly constricted where it joins the abdomen, and in the central part of the juncture are about five very short radiating lines; there are not any other markings on the cephalothorax. Rostral hairs thick; the palpi show slightly at the side of the rostrum and are well provided with hairs. Pseudo-stigmata at the very base of the cephalothorax, almost under the edge of the abdomen. Pseudo-stigmatic organs *very short*, with *obtusely pyriform clubs* on *short and slender peduncles*. Interlamellar hairs long and setiform, *much longer than the pseudo-stigmatic organs*, slightly serrated. Tectopedia large; first apodemata not joined to sternum. Lamellæ *very short, slightly raised, nearly straight blades, nearer together at their distal than at their proximal ends*. Lamellar hairs longish, slightly serrated.

**Legs** longish; femora powerful, tibiæ and tarsi fine and attenuated; the fourth pair of legs project considerably behind the body when stretched out. The tactile hair is present on each tibia, and is very long on the first leg; the other joints, except the coxa and tarsus, bear whorls of fine curved hairs, mostly set rather nearer the proximal than the distal end. The tarsi, as usual, are thickly set with fine hairs. *Claws tridactyle almost homodactyle*.

**Abdomen** elongated, oval; with rounded, and very

slightly sinuated anterior margin, bordered by a raised line, except in the middle, where the abdomen almost coalesces with the cephalothorax ; and having a rounded point posteriorly ; it is much arched, and is entirely covered with rather large and clear punctures. A strong, straight spine projects from the edge of the abdomen, between the second and third legs, and there are four longitudinal rows of long, fine, curved hairs on the notogaster, and an extra pair near the posterior margin. Genital and anal plates nearly square (the latter the larger), at opposite ends of the abdomen.

This species is extremely like *N. pilosa*, so much so that I had at one time grave doubts whether the two species were really distinct ; I think, however, that the smaller size, less pointed shape, and much redder colour of *N. pilosa*, the much greater length of the hairs on the notogaster in that species, and more especially the much greater length, and more gradually pyriform shape, of the pseudo-stigmatic organs in *N. pilosa*, constitute a sufficient distinction ; moreover *N. pilosa* is rare and is not usually found with *N. lucorum*.

*N. lucorum* is an extremely variable species, both in shape and size ; the abdomen is much longer in proportion, and more pointed in some specimens than in others ; the breadth also varies considerably. The whole creature is, however, always larger and more pointed than *N. pilosa*.

### *Nymph.*

This is a very beautiful creature.

**Colour** of rostrum and legs light rosy-brown, of hind part of cephalothorax and abdomen semi-transparent white ; the internal organs partly show through the integument, the ventriculus and expulsive glands red-brown to crimson, the rest of the alimentary canal and its cæcæ yellow or green, the preventricular glands nearly black ; these colours vary considerably, but usually give a diversified and pleasing appearance.

**Texture** polished, with numerous dots and short vermiform markings.

**Form** very similar to that of the adult.

**Cephalothorax.**—Rostrum small, pointed; palpi showing at the side. Pseudo-stigmata small, much further forward than in the adult. Pseudo-stigmatic organs lamellar and interlamellar hairs similar to those of adult.

**Legs** rather short, the fourth pair do not reach the hind margin. Tactile hairs very long; other hairs much as in the adult.

**Abdomen** not very clearly divided from the cephalothorax, somewhat truncated anteriorly, rounded posteriorly. The expulsive vesicles form large red patches at the lateral edge near the hind margin. The spine at the antero-lateral corner of the abdomen is replaced by a hair; hairs on the notogaster similar to those of adult.

**Distribution.**—Abundant and generally distributed, it swarms in the lichen at such sea-coast places as the Land's End, the Gower, and North Welsh coasts, &c. Its capture (without any name) was recorded by Mr. Underhill in the 'Notes of the Postal Microscopic Club,' on 10th December, 1877. It has been recorded in Germany.

### NOTASPIS OBLONGA\* (Koch). Pl. XXX, figs. 6—11.

*Eremaeus oblongus*, Koch. Heft 3, fig. 24.

— — Nic. P. 451, pl. x, fig. 1.

— — Haller, p. 306.

— — Berlese, Acarofauna Sicula, p. 10.

*Murcia obsoleta*, Koch. Heft 31, fig. 23, Nymph?

Average length about .60 mm.

Average breadth about .38 mm.

Average length of legs (first pair) about .68 mm.

\* *Oblongus*, longish-square shaped.

Average length of legs (second and third pairs) about .52 mm.

Average length of legs (fourth pair) about .68 mm.

This species may be noticed by the short but conspicuous ridge-like lamellæ near together and almost parallel. It will be observed that previous authors have considered it to be an *Eremæus*, to which genus it undoubtedly has some analogy; but I think that, in spite of this, it is more properly included in the genus *Notaspis*, subject to the remarks which I have made in the introduction to the genus *Eremæus*. It is a varying species.

**Colour** dull red-brown or yellow-brown; often with a purple shade.

**Texture** dull, without polish, but still smooth.

**Cephalothorax** rather large and long, constricted where it joins the abdomen; the pro-vertex is particularly distinct. Rostrum pointed, not very sharply. There are two pairs of rostral hairs, both fine and curved, but the hinder pair are considerably the larger; possibly these may be the homologues in some way of the absent lamellar hairs; although the position is not quite consonant with this view. Lamellæ two short, nearly but not quite straight, *almost parallel* bars, near together, and *commencing some distance in front of the pseudo-stigmata*. Translamella a long bar, apparently not quite joined to the lamellæ. Pseudo-stigmatic organs rather long, with slender peduncles and fusiform heads; both peduncles and heads are roughened with small spines. *Interlamellar hairs considerably shorter than pseudo-stigmatic organs*; they are curved, very close to the pseudo-stigmata, and slightly rough. Tectopedia well developed, the third pair form strong, bifid-headed projections behind the second pair of legs. Apodemata very strong, and distinctly joined to the sternum, which is also large. The dorso-vertex between the pseudo-stigmata is somewhat raised and rough.

**Legs** rather long, but of the ordinary type of the genus. The fourth coxa with an extremely sharp point at the upper angle. All the femora, except the first, with strong blades. Genuals small. Tibiae long with slender peduncles, particularly the two hinder pairs; and distal ends considerably enlarged. Tarsi short, inversely pyriform; claws very heterodactyle. Tactile hairs large, a whorl of fine curved hairs on most of the other joints; tarsi clothed as usual.

**Abdomen** oval or elliptical, varying in form as stated below. Progaster slightly truncated. Notogaster finely punctured all over, but without other markings. There are some moderate-sized, curved, fine hairs round the hind margin, and four longitudinal rows of similar hairs on the notogaster. The genital and anal plates are pentagonal with rounded angles and are always large and near together, but more so in some specimens than others; in some they occupy almost the whole length of the ventral plate, in others they are some little distance apart; this seems to depend, not upon sex, but upon the shape of the abdomen, which varies. The dorsal plate turns under at the lateral edge and embraces the ventral, but at the extreme hinder end the dorsal is suddenly scooped out (as seen from below), and ceases to embrace the ventral; upon the membrane which lines the plates and joins them, there is, in some specimens, an imperfectly chitinised oblong plate lying in the scooping-out of the dorsal; this oblong plate is not seen in all specimens and is often very slight; in some small specimens which I obtained at the New Forest it is so strongly developed and so large that I have doubted whether they really were the same species; I fancy that it is more or less retractile. A broad, lancet-shaped, chitinous, flat, median point projects from the rear of the ventral plate and passes over and rests on the oblong plate, which thus becomes a catch to secure the ventral plate. Where the oblong plate is strongly developed, and appears to proceed from, or be closely attached to, the dorsal plate, the

posterior end of the latter, and consequently of the abdomen, is rounder than in other specimens.

### *Nymph.*

This nymph is probably the creature which Koch described as a separate species under the name of *Murcia obsoleta*.

**Colour** varies from light ochre-brown to dark brown, sometimes with a slight golden tinge. The creature in life has rather a metallic look. The food in the alimentary canal often shows through and imparts a greenish colour to parts of the abdomen. It is one of the darkest nymphs in the family.

**Texture** rough and without gloss.

**Shape** more or less oblong (if the rostrum be excluded).

**Cephalothorax** not much more than a fourth of the entire length. Rostrum rather narrow, bluntly pointed. There is an indentation above the insertion of the first pair of legs ; thence the cephalothorax widens rapidly until, near the abdomen, it is nearly as wide as the pro-gaster ; it has a rounded lateral margin. At its posterior edge the cephalothorax is sharply bevelled off, apparently to admit of retraction and other motion upon the abdomen. This produces a sharp indentation over the second pair of legs. The two longitudinal parallel ridges, which are so conspicuous in the adult, are almost equally so in the nymph, and less well-marked ridges run outward from them to the pseudo-stigmata. There are a few transverse markings between the parallel ridges, and the hinder part of the cephalothorax is granulated. Rostral hairs rather short, curved inward. There is another pair of larger similar hairs a little further back, which may possibly be the homologues of the lamellar hairs. Pseudo-stigmata rather wide apart, pointing upward. Pseudo-stigmatic organs rather long, with slender peduncles and large

lanceolate heads. Interlamellar hairs shorter than the pseudo-stigmatic organs, straight, and inserted very near the progaster.

**Legs** of moderate length ; fourth pair slightly passing the hind margin. The two front pairs are the thicker. The femora of all the legs, and the coxae of the two hind pairs, are flattened on the inside so as to fit against the body, and bowed exteriorly. The femora have chitinous ridges bordering the flattened surface, both above and below, and there is a similar ridge on the upper edge of the fourth coxa. All the coxae and femora are rough. The tactile hairs are very long and flexible on the first pair of legs, shorter but similar in character on the second pair ; there is also a long, flexible hair on each first genual. There are a pair of short curved hairs on each of the three middle joints of each leg, and a few other similar hairs ; the tarsi are thickly clothed with fine hairs. The claws are long and thin, and their curves open.

**Abdomen** shield-shaped, sharply narrowed at the progaster. Lateral margins striated with fine, irregular transverse wrinkles ; central parts of the notogaster granulated. The cast notogastral skins are carried flat on the back and excentrically, the centre of each skin being rather further back than the centre of the skin that underlies it ; thus each shield projects a little beyond that below it at the posterior margin, but the larval skin does not project beyond the first nymphal. All the skins have a slightly raised or rolled striated margin, and a granular, very slightly convex central area, showing a few transverse folds or striae. The progaster is nearly straight, and bears a row of short, curved hairs directed backward, except the edge hair, which points outward.

**Distribution.**—The species is generally distributed and very common. It has been recorded in France, Germany, and Italy.

NOTASPIS LICNOPHORA,\* Michael. Pl. XXXI, figs. 6—8.

*Notaspis licnophorus*, Michael. Further notes on British Oribatidae. Journ. Roy. Microsc. Soc., series 2, vol. ii, p. 2.

Average length about ·19 mm.

Average breadth about ·11 mm.

Average length of legs (first and fourth pairs) about ·10 mm.

Average length of legs (second and third pairs) about ·08 mm.

This extremely minute species is easily distinguished by the disproportionately large size and unusual shape of the pseudo-stigmatic organs, from which the name was derived.

**Colour** light yellow-brown.

**Texture** smooth but dull, occasionally polished.

**Cephalothorax** considerably narrower than the greatest width of the abdomen, but at the actual junction the cephalothorax is the wider. Rostrum with a small median point, then widening at an obtuse angle up to the translamella, and posterior to this the cephalothorax becomes suddenly wider and more parallel-sided. Rostral hairs rather short and curved. Lamellæ strongly-marked, thickened bars or ridges, starting from the pseudo-stigmata, and curving outward, then strongly inward, and finally becoming more parallel, but always with a more or less curved and slightly irregular line. Just in front of the abdomen the two lamellæ are joined by a transverse bar, which is not straight but has a strong median point directed backward, and a smaller lateral point, far less distinct, near each lamella pointing forward, giving a zigzag, or, if the points be not sharp, an undulating line. Translamella very strong, and extending entirely across the cephalothorax. These four ridges enclose a nearly square smooth space on the dorso-vertex. Pseudo-

\* Λίκνον, a fan; φέρω, I bear.

stigmata lateral, almost hidden by the advancing edge of the abdomen. *Pseudo-stigmatic organs with very short peduncles and extremely large, flat, Indian or Japanese fan-shaped heads*, the distal edge of which has a median, or nearly median, indentation or curving in. The whole of the flat expansion is strewn with extremely fine hairs or points. In consequence of the singular form of these organs they may often be observed to be blown about a little by the wind. Second tectopedia well developed, the others small. The appearance of the apodemata and sternum will be best understood from the plate (fig. 7).

**Legs** of moderate length. The two hind coxae large and globose. Femora, especially the two anterior pairs, with thin peduncles and greatly enlarged distal ends. Genua very small. Tibiae almost wine-glass-shaped. Tarsi short but thick at the proximal ends, inversely pyriform. Claws *tridactyle*, *very heterodactyle*. Tactile hairs on first pair of legs long. There are one or two short, rather spatulate hairs on most joints of the legs, particularly the anterior pairs. Tarsi with the usual fine hairs, and there are a few on the other joints.

**Abdomen** pointed both anteriorly and posteriorly; anteriorly it projects over the cephalothorax and becomes narrow, so that the progaster is gable-shaped; the sides of the remainder of the abdomen are strongly curved. There is a close row of short, curved, spatulate hairs round the margin, and two longitudinal rows of three or four similar hairs near the median line.

### *Nymph.*

The nymph of this species so closely resembles the adult that I do not think anyone would mistake it; I therefore have not figured it, and here only give the differences from the perfect creature (beyond the ordinary fact of the nymph being monodactyle instead of tridactyle).

The **colour** of the nymph is pure milky-white, without a speck of darker marking.

The general thickness of the **legs** is greater in the nymph, but the shapes of the joints are not so varied, and the greatly enlarged ends are not present.

The lamellæ and other ridges described as being on the **cephalothorax** of the adult are not present on that of the nymph.

The hairs bordering the **abdomen** are rather smaller in the nymph than in the adult.

The skin of the nymph is covered with slight wrinkles or vermiform markings instead of being smooth.

**Distribution.**—I have found the creature in decayed wood at Tamworth in Warwickshire, and at Epping Forest, where it is not uncommon. I have not found it elsewhere, and I am not aware that anyone has done so, but it will doubtless be found; it is very small and troublesome to look for.

#### NOTASPIS MONILIPES\* (*Michael*). Pl. XXXI, figs. 1—5.

*Damœus monilipes*, Michael. Further notes on British *Oribatidae*  
Journ. Roy. Microsc. Soc., series 2,,  
vol. ii, p. 16, pl. ii.

Average length about .34 mm.

Average breadth about .18 mm.

Average length of legs (first pair) about .17 mm.

Average length of legs (second and third pairs) about .15 mm.

Average length of legs (fourth pair) about .19 mm.

An extremely minute but rather elaborately formed and exceptional species, remarkable for the size of the first pair of tibiæ; it is very sluggish.

**Colour** rather light brown when young, darker when old.

\* *Monile*, necklace; *pes*, foot.

**Texture** rough, not strongly chitinised, rather more leathery ; in this and in some other respects approaching the genus *Nothrus*; like many other *Oribatidæ* which have this texture and are thus not as fully protected as harder species, *N. monilipes* makes up for the deficiency by covering itself with dirt to such an extent that it is almost impossible to get it clean ; its small size being an additional difficulty. The figure and this description are taken from carefully cleaned specimens, otherwise many of the details would not be seen. Another source of error which must be avoided in identifying the species is, that the elevations on the notogaster are apt to lose their form and to be difficult to see shortly after death, particularly if treated with reagents ; by care, however, the true form may be preserved.

**Cephalothorax** and abdomen very sharply divided, the former large and having a dorsum practically divided into three regions, viz. firstly, the rostrum, which is short and conical, not very sharp-pointed, and carries small curved rostral hairs ; secondly, an almost square plate-like region, bordered by the translamella in front and the first pair of tectopedia laterally, and divided into three parts by the lamellæ. This region is strongly reticulated, reticulations about 160 to the millimètre, the ridges forming the reticulations rough and not above one fourth of the width of the inter-spaces ; this region has a slight transverse depression about the centre. Thirdly, a transverse arch, or roll-like region, over which the lamellæ usually, but not invariably pass, and which is generally rough with raised dots or ridges instead of being reticulated. This part bears the pseudo-stigmata. Lamellæ very rough thickened bars or ridges, almost parallel and near together ; there is a sudden break in the middle of the square region secondly above referred to and anterior to this break the lamellæ are a trifle further apart. *Cusps long, rough, curving downward*, and bearing moderate-sized curved lamellar hairs ; if these cusps

and hairs did not indicate the true homologies, the first pair of tectopedia might well be taken for the lamellæ. Translamella a similar bar. Pseudo-stigmatic organs long, clavate, gradually thickened from the proximal until near the distal end ; rough, with small points or spines. First tectopedia rough, reticulated, straight blades or bars, more dorsal than usual ; bordering the square region secondly above referred to, and joined to the lamellæ by a transverse bar at the rear of that region. Second tectopedia also largely developed.

**Legs** rather short, fourth pair not reaching the hind extremity. Coxæ but little seen from the dorsal aspect ; femora rough ; genua longer than usual and more distinctly divided into peduncle and head than is generally the case with this joint. The tibiae of the two front pairs of legs, especially the first, are the most remarkable features of the species ; they seem *disproportionately large and have almost globular heads*, with a strong apophysis in the upper median line bearing the large tactile hair ; short slender peduncles spring from the upper rear part of the globe. Tactile hairs on all the legs, but much larger on the first pair ; a whorl of short curved hairs on most joints ; tarsi clothed as usual. Claws *monodactyle*.

**Abdomen** shield-shaped with curved sides ; its antero-lateral angles are produced into well-marked points, which curve towards the pseudo-stigmata, so that from the dorsal aspect two open spaces are seen, bounded on the outside by these points and anteriorly by the coxæ of the third pair of legs. Immediately behind the anterior margin there is a broad, rounded, transverse elevation, not reaching the lateral margin ; behind this is a deep linear depression, and then the centre of the abdomen, until within a quarter of its length from the hind margin, is occupied by a domed lump, followed by a smaller one, which touches the hind margin. Exterior to these elevations the abdomen is a broad, almost flat expansion, which seems to form a flat annulus round the central elevation ; at the extreme

edge of this is often a narrow, ill-defined, rough ridge bearing several short, thick hairs or spines; the annulus curves downward towards the margin, but not very strongly. The whole surface of the abdomen is rough and irregularly sprinkled with raised dots, which are far largest and most conspicuous on the central lump. Genital plates square; anal plates more oblong—the two pairs of plates near together and placed far forward.

*Nymph.*

This is also rather a complicated creature, not very easy to describe.

**Colour** light oak-brown, with a tendency to a grey dusty effect over the raised parts of the cuticle.

**Texture** like fine shagreen.

**Cephalothorax** rather more than one-third of the whole length; at its base it is nearly as wide as the abdomen. Rostrum rounded and slightly truncated, a blunt point on each side of the truncation carries the curved rostral hair. The cephalothorax appears, as in the adult, to be arranged in three spaces. Firstly, the rostrum, which bears two longitudinal ridges commencing close to the above-named points but sometimes a trifle nearer the lateral margin. Secondly, a region which extends from the rostrum to the insertion of the first pair of legs, and has a central shield-shaped space on the dorsal surface, enclosed by a raised ridge, against the front of which the ends of the before-named longitudinal ridges abut. A smaller space, narrower in proportion, on the slope of each side, is often enclosed by a ridge. Thirdly, a region extending to the abdomen, and which has a central octagonal space enclosed by a similar ridge and abutting on the shield-shaped ridge anteriorly, and on the abdomen posteriorly. On each side of the octagon is a rounded, somewhat mammiform portion, bearing the pseudo-stigma, which is

dorsal. The pseudo-stigmatic organs are long, filiform, rough, and sinuous.

**Legs** rather short, of almost even thickness throughout; rough. There is a projecting point on each front tibia, which bears a very strong, tactile hair; most of the other joints have a pair of short, curved, spatulate hairs; tarsi short and thick.

**Abdomen** shield-shaped. The cast notogastral skins are carried excentrically, all starting from the progaster, but each lower skin extending further backward than the skin above it. The notogaster is somewhat raised along the median line, and slopes up to it from both sides; otherwise the cast skins are carried flat on the back, except that the edges of each skin have curled, and form a bordering ridge to it. Within the space enclosed by the inner ridge, *i. e.* upon the larval skin, are three hemispherical knobs arranged longitudinally; and also in the same median line at the posterior end of the creature, and of each cast skin, is a less well-defined knob having two points posteriorly; each point bears a long, spatulate, curved hair.

**Distribution.**—The species lives in dead wood; I first found it in some material sent to me from near Leeds. I have since found it at Hopwas Wood near Tamworth, and in other places. I am under the impression that it is fairly generally distributed and not uncommon, but it requires very careful searching to find it.

NOTASPIS QUADRICARINATA,\* Michael. Pl. XXXI, figs. 13  
—15.

*Notaspis quadricarinata*, Michael. Journ. Roy. Microsc. Soc.,  
ser. ii, vol. v, p. 393, pl. vii.

Average length about ·2 mm.

Average breadth about ·13 mm.

\* *Quadrus*, four-square; *carina*, a keel.

Average length of legs (first pair) about .11 mm.  
Average length of legs (second pair) about .10 mm.  
Average length of legs (third pair) about .12 mm.  
Average length of legs (fourth pair) about .13 mm.

A minute, thick-set, and well-marked species.

**Colour** light yellow-brown.

**Texture** polished, without any markings or punctures that are visible with say 200 diameters amplification.

**Shape** short-pyriform.

**Cephalothorax** long and large, about five-twelfths of the entire length of the creature, forming a truncated cone. Rostrum rounded, blunt. Rostral hairs short. Palpi not showing from the dorsal aspect. Lamellæ very strong and clearly-marked ridges, almost blade-like; short and very slightly undulated; *without cusps* but the ends joined by a *very strong translamella*. Pseudo-stigmata large, placed rather near together. Pseudo-stigmatic organs short, slightly recurved, with thick fusiform heads on short peduncles. I have not been able to detect any interlamellar hairs. There is a short, doubly-curved ridge on each side of the rostrum, starting from above the insertion of the first leg and terminating a little in front of the lamella; and a single transverse ridge joining the pseudo-stigmata close to the progaster. Tectopedia small. Apodemata joined to the sternum.

**Legs** rather short, joints thick, except the hind tarsi. Femora without blades. Tactile hairs on all tibiæ and a few other fine hairs on the respective joints. *Claws monodactyle*.

**Abdomen** short and arched, truncated anteriorly. There are *four longitudinal ridges on the anterior part of the notogaster*, the central pair of which turn at right angles and run a short distance along the progaster and then return to the notogaster, running parallel to their original course and looking like two shorter extra ridges. There are four sparse rows of short, fine hairs on the notogaster. Genital and anal plates

large, rather near together, approximately square, about equal in size.

**Distribution.**—In moss, apparently rather generally distributed.

NOTASPIS CLAVIPECTINATA,\* *Michael*, Pl. XXXII, figs. 7—11.

*Notaspis clavipectinata*, Michael. Journ. Roy. Microsc. Soc., ser. ii, vol. v, p. 392.

Average length about .33 mm.

Average breadth about .19 mm.

Average length of legs (first pair) about .21 mm.

Average length of legs (second and third pairs) about .18 mm.

Average length of legs (fourth pair) about .25 mm.

A small species, which may be recognised by the form of the pseudo-stigmatic organs.

**Colour** lightish, but not very light, yellow-brown.

**Texture** polished, without any markings or punctures that are visible with, say, 200 diameters amplification.

**Cephalothorax** of moderate length. Rostrum conical, rounded anteriorly. The cephalothorax behind the rostrum would be square were it not for a slight constriction about the middle, which gives the sides an undulated appearance. Rostral hairs short, nearly straight. Palpi projecting at the side of the rostrum. No lamellae nor translamella. Pseudo-stigmata rather large, close to the abdomen. *Pseudo-stigmatic organs* nearly upright, rather long, with thin, filiform peduncles, and short, flat, pyriform heads, from the outside of which some stiff bristles, about as long as the head, radiate. Interlamellar hairs setiform, shorter than the pseudo-stigmatic organs. Second tectopedia greatly

\* *Clava*, a club; *pectinatus*, made like the teeth of a comb.

developed, forming large receptacles for the support of the first pair of legs. Apodemata joined to the sternum.

**Legs** rather long, hind pair reaching considerably beyond the posterior margin of the abdomen. Femora slim and without blades. *Claws monodactyle*. There are a few fine curved hairs arranged in a whorl on each joint of the legs except the tarsi, which are provided with numerous fine hairs as usual.

**Abdomen** elliptical, the breadth of the ellipse varies considerably in different specimens. There are two longitudinal rows of fine hairs near the middle of the notogaster and a border of similar hairs near the edge. Genital and anal plates far apart, nearly square, the anal plates much larger than the genital.

### *Nymph.*

The form and general effect of the creature are very similar to those of the adult.

**Colour** light pearly-grey, almost white, sometimes semi-transparent.

**Texture** smooth, scarcely polished.

**Cephalothorax** much as in the adult, but wider posteriorly. Pseudo-stigmatic organs rough, but without the well-marked pectinations of those of the adult. Lamellar and interlamellar hairs strongly bipectinated.

**Legs** without the thin peduncles to the joints which are found in the adult.

**Abdomen** very like that of the adult, but truncated anteriorly instead of being rounded. Hairs on the notogaster arranged in rows, &c., similar to those of the adult, but rather more numerous, and all strongly bipectinated.

**Distribution.**—I found this species in considerable numbers in an old thatched roof in Warwickshire, it may probably be found in other classes of situations,

but cannot be distinguished without a considerable amplification.

NOTASPIS PECTINATA,\* *Michael.* Pl. XXXII, figs. 1—6.

*Notaspis pectinata*, Michael. Journ. Roy. Microsc. Soc., series ii, vol. v, p. 392.

Average length about ·42 mm.

Average breadth about ·22 mm.

A small species but not one of the smallest in the genus ; it is readily distinguished by the form of the pseudo-stigmatic organs.

**Colour** rather light yellow-brown.

**Texture** smooth but not quite polished, there are no punctures visible with, say, 200 diameters amplification, but a few slight irregularities often break the surface.

**Shape** almost fusiform.

**Cephalothorax** rather small, its base considerably narrower than the anterior margin of the abdomen, but the sort of lateral shelf which carries the tectopedia is wide. Rostrum pointed; rostral hairs of moderate length. Palpi not showing. *Lamellæ mere ridges*, very short, and sloping forward and inward, but with a considerable space between their anterior ends. There is a second pair of ridges, more curved, at the base of the rostrum. *No translamella.* Pseudo-stigmata small and lateral. Pseudo-stigmatic organs *very long*, sinuous, *i. e.* doubly curved, *forming a line of beauty*, the general direction being backward, upward, and outward. They are slightly thickened in the middle and have *a few widely separated pectinations* upon the middle and part of the anterior portion, these are on one side only and often difficult to see. Interlamellar hairs setiform, of moderate length, not nearly so long as the pseudo-stigmatic organs. Apodemata joined to the sternum.

\* *Pectinatus*, made like the teeth of a comb.

**Legs** of moderate length, hind pair extending a little beyond the posterior margin. Femora without blades. Claws *monodactyle*. Tactile hairs on all tibiæ; a whorl of fine hairs on each of the three central joints of each leg, and the usual fine hairs on the tarsi.

**Abdomen** acorn-shaped, rounded and slightly truncated anteriorly, pointed posteriorly; without markings on the notogaster, which bears two longitudinal rows of fine hairs. Genital and anal plates large, near together, almost pentagonal.

The ventral plate turns up posteriorly, passes within the dorsal, and curls forward, thus making a rounded return inside the creature, which is seen indistinctly through both the dorsal and ventral plates, and has a very puzzling appearance, looking as if one of the two plates (dorsal and ventral) were shorter than the other and rounded posteriorly, which is not the case. The true structure may be ascertained by dissection.

### *Nymph.*

This creature is active and walks fast.

**Colour.**—Almost colourless, very slightly shaded with grey or yellowish.

**Texture** tolerably smooth, but entirely without polish.

**Cephalothorax** about one third of the entire length of the nymph. Rostrum rather broad and rounded. Rostral hairs long and slightly serrated, placed far back. Palpi showing plainly at the side of the rostrum. Behind the rostrum the cephalothorax widens considerably, with a strong rounded shoulder on each side; where it joins the abdomen it is almost as wide as the progaster. Pseudo-stigmata small and dorsal. Pseudo-stigmatic organs very long, curving sharply forward and downward at the distal ends, imbricated or slightly serrated. Inter-lamellar hairs similar in size and character to the pseudo-stigmatic organs, placed far forward.

**Legs** of moderate length and about even thickness throughout, genuals and tibiæ much shorter than the femora and tarsi. Each of the three central joints of each leg has two or more short, sharply curved, imbricated or serrated hairs. There are tactile hairs on the front tibiæ and the usual fine hairs on the tarsi. The creature shakes the first leg tremblingly at each step ; this is evidently a kind of tactile motion.

**Abdomen.**—Almost oblong, but slightly narrowed posteriorly ; the antero-lateral angles project a little, and there are four largish papillæ on each side of the abdomen, and four smaller much closer together on the posterior margin. Each papilla bears a long imbricated or slightly serrated hair, which is curved along its whole course, but the curve becomes much sharper towards its distal end and is there directed downward. The hairs from the two anterior papillæ on each side are the longest ; the first of these is directed slightly forward, the other peripheral hairs more or less backward. There are two longitudinal rows of four papillæ each on the notogaster ; these bear hairs similar to those just described. The first three pairs stand nearly upright, the first being the shortest ; the fourth pair are far the longest hairs on the body and almost horizontal ; they are doubly curved and curled round at their ends, and in form resemble the great feathers in the tail of the Lyre-bird.

**Distribution.**—For many years I had only two or three specimens of this species, which I found at the Land's End, Cornwall, but in December, 1885, I dug up several moles' nests in the Midland Counties to search for other *Acari*, and amongst the dead leaves which composed some of these subterranean nests I found a considerable number of adults of the present species, and from them, when kept in my own cells, I succeeded in breeding the nymphs.

I am not aware that the species has been captured by anyone except myself.

NOTASPIS LONGILAMELLATA,\* *Michael.* Pl. XXVIII, figs.  
13—15.

*Notaspis longilamellata*, Michael. Journ. Roy. Microsc. Soc.,  
ser. ii, vol. v, p. 391.

Average length about .33 mm.

Average breadth about .18 mm.

Average length of legs (first pair) about .17 mm.

Average length of legs (second and third pairs) about  
.16 mm.

Average length of legs (fourth pair) about .18 mm.

A small species, chiefly distinguished by the length of the rostrum; the length of the lamellæ, which approach near to the tip of the rostrum; and the form of the pseudo-stigmatic organs.

**Colour** rather light yellow-brown.

**Texture** polished, without any markings or punctures that are visible with, say, 200 diameters amplification.

**Shape** elongated, pyriform.

**Cephalothorax** very long, about five twelfths of the whole length of the creature; rostrum pointed, conical; the hinder part of the cephalothorax almost square. Rostral hairs small, nearly straight. Palpi usually showing almost at the tip of the rostrum. *Lamellæ* mere thickened bars or ridges, they are very long, reaching more than halfway along the rostrum; for about one third of their length (commencing from the pseudo-stigmata) they approach one another at angles of nearly 45° with the median line, then they suddenly turn straight forward, and continue parallel until their terminations. No cusps. No *translamella*. Two short, paired ridges are situated at the base of the cephalothorax between the pseudo-stigmata; each commences with a small, chitinous, almost half-moon-shaped projection close to the abdomen and close to

\* *Longus*, long; *lamella*, the lamella.

the median line; thence the thinner ridge runs outward and slightly forward, until it nearly touches the pseudo-stigma, then it turns sharply inward and forward at an angle of about  $45^{\circ}$  with its former course, and terminates in a very short piece bent forward, or slightly outward, between the commencement of the lamellæ. Pseudo-stigmata large and lateral. Pseudo-stigmatic organs with long filiform peduncles, and very short, fusiform (pointed) heads. Interlamellar hairs shortish and setiform. Second tectopodium well developed; the others small. Apodemata joined to the sternum.

**Legs** rather short, the hind pair not reaching the posterior margin. Femora without blades. *Claws monodactyle*. There are a few fine hairs on each of the three central joints of each leg; large tactile hairs on the tibiæ, and the usual fine hairs on the tarsi.

**Abdomen** truncated anteriorly, rounded posteriorly. Progaster almost straight. Antero-lateral angles slightly produced so as to form small, chitinous, blunt points. There are two longitudinal rows of sparse fine hairs on the notogaster, and a series of similar hairs round the margin. Genital and anal plates rather small, pentagonal, far apart.

**Distribution.**—I have found this principally in Epping Forest.

NOTASPIS SPLENDENS\* (*Koch*). Pl. XXXIII, figs. 10, 15.

*Oppia splendens*, Koch, Hft. 32, pl. vi.

*Dameus splendens*, Michael. Journ. Roy. Microsc. Soc., ser. i, vol. ii, p. 247.

Average length about .31 mm.

Average breadth about .15 mm.

Average length of legs (first pair) about .14 mm.

Average length of legs (second pair) about .13 mm.

\* *Splendens*, shining.

Average length of legs (third pair) about .15 mm.  
Average length of legs (fourth pair) about .17 mm.

In identifying this small and variable species with Koch's *Oppia splendens* it must be understood that I select it as being a common and typical form among a number of minute and closely allied creatures, all of which Koch probably included in his species ; indeed it is more than likely that he had not the means of distinguishing them.

**Colour** light yellow-brown.

**Texture** polished, without any punctures or marking visible by an amplification of, say, 200 diameters.

**Cephalothorax** rather longish, slightly constricted at the base. Rostrum rather rounded, although with a median non-projecting point, as shown in the drawing ; frequently just the points of the mandibles project, giving the rostrum a much more pointed or sometimes a trifid appearance. Rostral hairs very fine. Lamellæ ridges of moderate length, usually springing from the edge of the abdomen, so that there is a short portion behind the pseudo-stigma ; the principal length starts from the front of the pseudo-stigma and runs first forward, then obliquely inward and forward, then straight forward again, with sometimes a slight final turn outward ; the ends are separated by a considerable distance. The proportions and precise form of the different portions of the lamellæ vary considerably in different specimens. There are not any lamellar hairs. Nearer the median line are two shorter ridges which often seem to start from a slight median projection of the abdomen and run outward and forward, then turn at a sharp angle and run inward and forward, then straight forward or else outward and forward, in which latter case they sometimes turn inward again at a sharp angle, so that each ridge forms two zig-zags. There is considerable variety in these ridges, the drawing may probably be taken as about a type-form. *No translamella.* Pseudo-stigmata rather projecting.

Pseudo-stigmatic organs longish, with slender peduncles and fusiform heads roughened with small points or hairs. I have not observed any interlamellar hairs. Tectopedia small. Apodemata joined to the sternum.

**Legs** of moderate length. Femora without blades; claws *monodactyle*. Tactile hairs on all tibiæ; tarsi clothed as usual, and a few fine hairs on the other joints.

**Abdomen** an oval varying in proportions; the larger end forward, the posterior end slightly pointed; it is without markings but has four longitudinal rows of fine hairs on the notogaster. Genital and anal plates widely separated, the former small, the latter larger, forming a short oblong with rounded corners.

### *Nymph.*

Noticeable chiefly from the length of the hairs on the back.

**Colour** very light bluish-grey, almost white, or colourless; often having a yellowish tinge where the alimentary canal is situated, the creature being semi-transparent.

**Texture** rather polished, but not highly so.

**Cephalothorax** without markings. Rostrum pointed, rather narrow, distinctly marked off from the hinder portion of the cephalothorax, which is much wider but not quite so wide as the anterior margin of the abdomen. Rostral hairs short, sharply curved. Pseudo-stigmatic organs similar to those of the adult. Interlamellar hairs long, near together, directed upward and curving forward.

**Legs** of moderate length, the fourth pair slightly passing the hind margin; the two anterior pairs of femora slightly thickened, and the joints having a tendency to a rounded form; otherwise the legs of about even thickness throughout. Tactile hairs very

long, on front pair of legs only. A pair of sharply-curved hairs on most of the joints except the coxae and tarsi; these hairs are longer on the front than the hind legs. Tarsi clothed with fine hairs.

**Abdomen** nearly elliptical, strongly arched, rounded posteriorly; somewhat truncated anteriorly. There are two longitudinal rows of about three very long, slightly serrated hairs near the median line of the notogaster, each hair standing upright but curving backward, and a series of similar hairs round the margin, standing outward and curving backward; there are also two pairs of shorter hairs on the hind margin, lower in level, and a very long and stout hair near each antero-lateral angle.

**Distribution.**—The species is abundant and generally distributed. The adult is found in moss, dead wood, decaying leaves, &c.; the nymph chiefly in the two latter. It has been recorded in Germany.

#### NOTASPIS TRIGONA,\* Sp. nov. Pl. XXVIII, fig. 16.

Average length about .24 mm.

Average breadth about .11 mm.

Average length of legs (first pair) about .15 mm.

Average length of legs (second pair) about .13 mm.

Average length of legs (third pair) about .12 mm.

Average length of legs (fourth pair) about .17 mm.

A minute species, only to be distinguished by the form of the rostrum and the markings on the cephalothorax, which will be best seen from the outline drawing.

**Colour** light yellow-brown.

**Texture** polished, without any punctures or markings visible by an amplification of, say, 200 diameters.

\* *Trigonos*, that has three corners, from *τρίγωνος*, same meaning (*τρι* thrice, *γωνία* an angle).

**Cephalothorax** rather longish, slightly constricted at the base. *Rostrum truncated, very angular*, having a small median and two lateral points. Rostral hairs fine, near together. Lamellæ mere bars or ridges, not starting from the pseudo-stigma but from a little distance in front of it; long, but becoming vague towards the anterior ends; the posterior portion are slightly bowed outward, and are considerably further apart than the anterior ends; the anterior portions are almost straight. There are two very short inner bars running from the abdomen as far forward as the pseudo-stigmata, and joined by a strong transverse bar between these organs; on this bar are two conspicuous points directed forward; this transverse bar with its points is sometimes much more distinct than the longitudinal bars. In front of and between, but quite detached from, the before-named two points is a small, somewhat pine-apple-shaped, azygous lump on the dorso-vertex pointing forward. No translamella. Pseudo-stigmata rather large, dorsal near together. Pseudo-stigmatic organs of moderate length, standing almost upright; they have slender peduncles and fusiform heads. I have not observed any lamellar or interlamellar hairs in the few specimens which I possess. Tectopedia rather well developed.

**Legs** longish, joints of the clavate form common in the genus. Femora without blades; claws monodactyle. The usual tactile hairs well developed, and a few fine hairs on most of the joints.

**Abdomen** almost elliptical, but slightly pointed posteriorly and very slightly truncated anteriorly. Notogaster without markings, but with two longitudinal rows of very small fine hairs and a few similar hairs round the border. Genital and anal plates small and placed at opposite extremities of the sternal plate.

I am not acquainted with the immature stages of the species. The few specimens which I possess were collected and mounted under the impression that they were *N. splendens*, a common species; it was

not until long afterwards that I discovered that they were different, therefore no special record of what part of England I got them from was kept, but probably it was Epping Forest.

The identification depends so much upon the small markings on the cephalothorax and on the shape of the rostrum that I have thought it best to give an outline of these parts rather than the ordinary figure.

NOTASPIS LANCEOLATA,\* *Michael.* Pl. XXXII, figs. 12—15.

*Notaspis lanceolata*, Michael. Journ. Roy. Microsc. Soc., ser. ii, vol. v, p. 394.

Average length about .33 mm.

Average breadth about .20 mm.

Average length of legs (first pair) about .21 mm.

Average length of legs (second pair) about .19 mm.

Average length of legs (third pair) about .20 mm.

Average length of legs (fourth pair) about .24 mm.

A small species which may be known by the short lamellæ meeting anteriorly, and the pseudo-stigmatic organs having terminal hairs.

**Colour** very light yellow-brown.

**Texture** polished, without any markings or punctures visible with, say, 200 diameters amplification.

**Shape** almost fusiform.

**Cephalothorax** rather short, conical, broad at the base. Rostrum pointed; rostral hairs long, almost straight. Palpi not usually seen from the dorsal aspect. Lamellæ short ridges starting from the pseudo-stigmata and running inward and forward until their ends meet only a short distance from the abdomen. Lamellar hairs long and setiform. Pseudo-stigmata near together, almost hidden by the progaster. Pseudo-stigmatic organs long, with thin peduncles

\* *Lancea*, a lance-head.

and slender fusiform heads, each head terminated by a single bristle. Interlamellar hairs long and setiform, standing erect. Second tectopedia well developed. Apodemata joined to the sternum.

**Legs** rather long, posterior pair extending considerably beyond the hind margin; slender. Femora without blades; claws *monodactyle*. Long tactile hairs on all tibiæ; a whorl of rather long, fine hairs on each of the three central joints of each leg, tarsi amply provided with fine hairs, and a few other rather long hairs on the various joints.

**Abdomen** a long oval, the larger end forward; it is without markings but has four longitudinal rows of rather long fine hairs, and there is a short spine on the anterior margin on each side, a little behind the pseudo-stigma. Genital and anal plates very large and close together, almost pentagonal.

**Distribution.**—Usually in moss, common and generally distributed.

NOTASPIS LACUSTRIS,\* *Michael.* Pl. XXXIII, figs. 1—9; Pl. XXX, fig. 12.

*Notaspis lacustris*, Michael. Journ. Roy. Microsc. Soc., ser. ii, vol. ii, p. 12.

Average length about .50 mm.

Average breadth about .33 mm.

Average length of legs (first and second pairs) about .30 mm.

Average length of legs (third pair) about .26 mm.

Average length of legs (fourth pair) about .40 mm.

This is strictly an aquatic species, but it is not properly a swimming creature, indeed I am not aware that any of the *Oribatidæ* are; it crawls about subaqueous plants, and is confined to fresh water, usually ponds or other water which is standing without being

\* *Lacustris*, belonging to lakes or ponds.

stagnant, and which contains growing water-weeds. It is interesting from the condition of the pseudo-stigmata and pseudo-stigmatic organs.

**Colour** dull reddish-brown, it is, however, generally more or less covered with a whitish, somewhat iridescent deposit, which is most commonly found in irregular strips and patches round the periphery of the abdomen. The creature is also occasionally found coated with diatoms, which adhere tightly to it.

**Texture** smooth but not polished. In dissections of favorable specimens it may be seen that the notogaster is finely punctured, punctures about 140 to the millimetre, distance between the punctures about three times the width of the punctures.

**Cephalothorax** less than half the length of the abdomen, almost conical, nearly as wide at its base as the progaster. Rostrum blunt-pointed; the point, which is rounded, is divided from the side of the rostrum by a slight notch; there is a thickened plate on the anterior part of the frons bearing the rostral hairs, which are short and curved. Mandibles short, very stout and strong, movable arm of the cheta the longest and quadridentate. Maxillæ remarkably strong, deeply dentate, and divided into two bifid lobes. Palpi with terminal joint thickened and slightly bifid at the distal end, the inner division being prolonged to a blunt point. No true lamellæ nor translamella, but there are two pairs of rather irregular ridges, one of which probably represents the lamellæ. The inner pair of these ridges are less than half the length of the cephalothorax, the outer, which are less constant, are at least three-quarters of its length; both spring from the base of the cephalothorax, where the two ridges of each pair are furthest apart, approaching more closely at their distal ends. As the creature is usually found neither the pseudo-stigmata nor the pseudo-stigmatic organs project at all from the cephalothorax; the former are exceedingly minute roundish holes, near the base of the cephalothorax, leading into short, some-

what S-shaped passages closed by membranes at the inner ends, and containing what appear to be the extremely small, filiform, pseudo-stigmatic organs which follow the shape of the tubes and do not project beyond (Fig. 5). This, however, is really a broken condition of the pseudo-stigmatic organ, which has a short, very thin peduncle projecting some little distance outside the pseudo-stigma, and a shortly-pyriform head; this peduncle, unlike those of the pseudo-stigmatic organs of all other species in the family which I know, is very brittle and usually breaks off short just outside the pseudo-stigma; so generally is this the case that when Pl. XXXIII was printed I had not ever seen a specimen with its pseudo-stigmatic organs perfect, and was not aware of the existence of the club; but about Christmas, 1886, I asked Mr. E. Bostock to send me a few specimens for duplicates: he kindly did so, not having examined what he sent further than to see that they were *N. lacustris*. On looking at them I was surprised to see the exterior clubs to the pseudo-stigmatic organs, and I have drawn one in a perfect condition in Pl. XXX, which had not then gone to press. I think the organs must be looked on as becoming abortive; possibly the time of year may affect the condition, specimens obtained from the same pond in May were without the organs. No interlamellar hairs usually seen. Tectopedia strongly developed; forming projecting cups, open above and in front, in the cavities of which the first and second pairs of legs are inserted. Lateral opisthophragmatic processes thin but distinct. Apodemata all joined to the sternum and all converging to the anterior edge of the opening for the genital plates; the second and third apodemata join before reaching the sternum.

**Legs** rather long and thin, the fourth pair being considerably the longest and reaching far back, the whole or the greater part of the tarsus projecting beyond the abdomen. The femora of the first pair are usually set inward, but the two distal joints of all the

legs have a tendency to be set outward. The femora and tibiæ of the first and second pairs of legs are long, the tarsi shortish ; in the two hinder pairs of legs the femora are reduced, the coxæ much larger, and the tarsi longer and thinner. The claws are monodactyle, and very large. The tactile hairs are long, and are found on all the tibiæ ; there are numerous hairs on the tarsi, and some on the other joints, chiefly arranged in whorls ; these hairs, when viewed by a low power appear fine ; but when seen by an amplification of about 700 diameters they are found to be extremely various in form, and to be most of them deeply serrated, in different modes of serration. Two or three of the hairs beneath each tarsus are lanceolate, and more or less pigmented. From each tarsus on each side of the claw springs a curious projection which by a low power appears to be a short, chitinous rod pointing forward, but a higher power discloses that they are somewhat of the texture of the lanceolate hairs, though stronger, broader, and shorter, more pigmented, truncated, and deeply serrated on the truncated edge ; on some tarsi there is one of these on each side of the claw ; on other tarsi two on each side, one above the other. Whether these projections be the homologues of the absent side-claws may be worthy of consideration, but I do not think that they are.

**Abdomen** a short ellipse, slightly truncated behind, and usually with small, paired incurvings of the lateral parts of the progaster. The central portion of the notogaster, between these incurvings, is occupied by a pale spot or patch arising from the thinness and light colour of the chitin in that situation ; this patch adjoins the progaster. From the hind truncated end of the abdomen spring two pairs of short, curved, fine hairs ; the inner pair are the longer. Genital and anal plates far apart, almost oblong, the former very small and placed far forward, the latter large, and near the hind margin.

*Nymph.*

**Colour** a dingy-white, passing into pale ochre-colour; legs and rostrum pinkish.

**Texture** leathery.

**Cephalothorax**.—Rostrum rather narrow, clearly marked off from the hinder part of the cephalothorax, which is dilated and nearly as broad as the abdomen, somewhat wrinkled, but without conspicuous markings. Rostral hairs short and curved, no pseudo-stigmata nor pseudo-stigmatic organs visible upon ordinary examination at the times of year when I have usually found the creature. In some specimens obtained early in May, 1887, although there were not any open pseudo-stigmata yet there were fine setiform pseudo-stigmatic organs, and very short spike-like interlamellar hairs close to them; there were also extremely fine lamellar hairs; all these were very caducous; they are not drawn in the figure.

**Legs** much like those of the adult, but the two front pairs of femora shorter and thicker, and the other joints more even in thickness and shape. Tactile hairs very long and black on all the legs; the other hairs on the legs are mostly short, and, excepting the fine hairs on the tarsi, chiefly thorn-like.

**Abdomen** oval, truncated, and somewhat concave at the progaster. The whole notogaster is covered with broad, irregular, wavy wrinkles extending from side to side. The elevated ridge of each wrinkle bears a series of round knobs or bosses. Round the hind margin are six thick, flexuous, intensely-black hairs, as long as the whole body of the creature. Between the two central of these hairs is a considerable space in which are a pair of large spikes directed backward, then on each side is a pair of the long hairs near together, then another space containing another spike, and then the third long hair.

**Distribution**.—Found in ponds and on fresh-water

weeds ; common and generally distributed. I am not aware that it has been recorded except by myself.

### GENUS—DAMÆUS,\* Koch.

Equals *Damæus* and part of *Oppia*, Koch.  
 Equals *Belba*, Canestrini and Fanzago.  
 Equals *Belba* and *Damæus*, Berlese.

*Apterogasterinæ* with cephalothorax anchylosed to abdomen ; without lamellæ ; with abdomen round or oval, notogaster arched, cuticle of adults fully chitinised, and long thin legs with clavate or moniliform joints.

To the above definition might be added, if regard were only paid to the species hitherto found in England, "claws monodactyle," but this would not hold good with some foreign species. Berlese's genus *Damæus* is wholly composed of tridactyle species, while he calls the monodactyle *Belba*, which scarcely seems a happy arrangement, as Koch originated the genus *Damæus*, and all his species were monodactyle. In the description of the genus *Notaspis*, I have already given my reasons for not considering the *Belba* of Hayden to be the same as the *Damæus* of Koch.

This is a distinct genus, well marked by its long legs, and the clavate or moniliform shape of the joints. The adults are usually very hard and chitinous, and most of them are among the largest species of *Oribatidæ* ; they are seldom polished, and are generally provided with longitudinal ridges on the cephalothorax, which vary in the different species. They are almost all very slow, inactive creatures. They were about the first *Oribatidæ* which attracted the attention of zoologists ; this was doubtless due to their size.

The **Rostrum** is usually rather small and narrow, and more or less pointed ; it curves downward and

\* Δαματος, a subduer, a conqueror.

has generally a slight tendency to a recurved apex. The rostral hairs are usually rather large and curved ; there is often a larger pair of hairs further back on the frons, like a second pair of rostral hairs ; possibly these may be the homologues of the lamellar hairs, but this seems doubtful.

The **Labium** rather short, not usually covering much more than half the mouth-opening, truncated anteriorly (Pl. XXXIV, fig. 10 ; Pl. XL, fig. 2), occasionally rather longer and with a median point (*D. tenuipes*, Pl. XXXVI, fig. 3).

The **Palpi** long, very frequently showing from the dorsal aspect ; they often seem too long to be packed away in the camerastomum. First joints short as usual ; second long and swollen ; third and fourth together usually not so long as the second ; fifth very long, often becoming rather suddenly thinner about the middle and occasionally having an appearance of a slight twist or bend at this point ; the distal end of this joint is usually provided with a tuft of short, fine, presumably sensitive hairs (Pl. XXXIX, fig. 6 ; Pl. XXXVIII, fig. 5). The palpus is often geniculated ; the fifth, or fourth and fifth joints being held almost at right angles to the more proximal joints ; this can be altered at the will of the creature (Pl. XXXVII, figs. 5, 6).

The **Maxillæ** well developed, but usually rather simple (Pl. XXXVIII, fig. 3).

The **Mandibles** generally rather powerful, but most commonly somewhat unusual in form, being bulbous or swollen in the proximal, muscle-containing part, and rapidly narrowed with a sweeping concave line as the fixed chela is approached (Pl. XXXV, fig. 6 ; Pl. XL, fig. 3). Chelæ tri- or quadri-dentate.

The **Pseudo-stigmata** usually very large, projecting and open, having a cup-like enlargement at the distal end, and sometimes ridges or ribs internally (Pl. XXXIX, fig. 7 ; Pl. XXXV, fig. 7). They are often borne on rounded lobes of the cephalothorax.

The **Pseudo-stigmatic organs** most commonly long and rod-like or spine-like; rarely clavate.

The **Interlamellar hairs** most frequently thick and curved, or rod-like; frequently there is a smaller hair on the outside of the pseudo-stigma.

The **Tectopedia** can hardly be said to exist in the genus, unless the strong, solid, chitinous projections between the first and second, second and third, and third and fourth pairs of legs in some species be considered to represent them; the second, third, and fourth legs are actually articulated to these projections in many species, and they form a very conspicuous feature in such forms as *D. geniculatus* and *D. clavipes*; Pl. XXXIX, fig. 1; Pl. XXXVIII, fig. 1.

The **Legs** always long and slender, usually much longer than the body; sometimes of extreme length (*D. clavipes*; *D. tenuipes*). Joints always clavate or moniliform, the femora in particular having very thin proximal ends; tarsi generally long and thin, often curiously twisted or undulated (Pl. XXXVI, fig. 9; Pl. XXXIX, fig. 9). Claws large and monodactyle in all species yet found in England, but tridactyle in some Italian species.

The **Abdomen** generally almost globular, occasionally more elongated; almost always with two longitudinal rows of hairs on the notogaster; these are usually thick and rod-like; they may be smaller and more curved (*D. verticillipes*), or may be very fine and recurved or hooked (*D. auritus*) or of other forms.

The **Genital and Anal Plates** usually near together (from the form of the abdomen) and rather square, the former generally the larger.

The **Tracheal system** very well developed (Pl. D, figs. 6, 7, 8, 9, 10, 17.)

The **Alimentary Canal** usually has the ingluvies very large and well-marked, with powerful circular muscles, but with the cæca of the ventriculus absent, or forming mere corners to that organ (Pl. E, figs. 4 and 5).

The **Ovipositor** very short and thick (Pl. G, figs. 1, 12).

The creatures of this genus are widely distributed ; they are found in moss, dead leaves, decaying wood, under bark, under stones, in old thatched roofs, &c.

The **Larvæ** and **Nymphs** usually fairly resemble the adult forms, but are soft and white instead of hard and black ; they are devoid of the chitinous ridges on the cephalothorax, and of the chitinous projections between the legs ; and the hairs on the notogaster, &c., are generally longer in proportion, more flexible, and black.

The **Eggs** are often provided with a very hard, dark, chitinous shell, and consequently the deutovium stage is very well marked and easily observed.

Many, both of the nymphs and adults of this genus carry either the cast notogastral skins, or else a coating of dirt, or even both, presumably as a protection ; the nymphs are sometimes almost matted up with dirt.

Table to assist in the identification of the British species of *Dameus*.

|                                                                           |                                                                                                                                                 |            |
|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Abdomen oval, almost pointed posteriorly                                  | Ventral plate very small; dorsal plate greatly reflexed on to the ventral surface . . . . .                                                     | NITENS.    |
| Hairs on the notogaster straight, thick, and rod-like, or slightly curved | Joints of the legs chiefly moniliform. Adults usually carrying cast nymphal skins and covered with white powder . . . . .                       | SUFFLEXUS. |
| Abdomen almost globular; rounded posteriorly                              | Pseudo-stigmatic organs setiform . . . . .                                                                                                      | TECTICOLA. |
| Ventral plate large; dorsal plate much less reflexed                      | Joints of legs clavate. Adult not carrying cast skins in any regular manner nor covered with white powder . . . . .                             | TENUIPES.  |
|                                                                           | Femora with thin proximal parts, the distal parts suddenly enlarged. Projection between 1st and 2nd legs pointed anteriorly CLAVIPES (filiform) |            |
|                                                                           | Femora gradually thickened. Projection between 1st and 2nd legs blunt anteriorly GENICULATUS.                                                   | AURITUS.   |
|                                                                           | Hairs on the notogaster fine, short, and very sharply curved, almost hooked . . . . .                                                           |            |

DAMÆUS NITENS,\* Koch, Pl. XXXIV, figs. 1—8.

*Oppia nitens*, Koch. Heft 3, pl. x.

Average length about ·51 mm.

Average breadth about ·29 mm.

Average length of legs (first pair) about ·35 mm.

Average length of legs (second pair) about ·32 mm.

Average length of legs (third pair) about ·38 mm.

Average length of legs (fourth pair) about ·48 mm.

**Colour** variable, some specimens are yellow-brown, rarely very light, some are rich chesnut-brown; all intermediate shades are found.

**Texture** highly polished.

**Shape** a long oval, more pointed anteriorly than posteriorly.

**Cephalothorax** pyramidal, long, being nearly one third of the entire length. Rostrum narrow, considerably arched; slightly rounded at the tip; rostral hairs fine and near together. The hairs on the terminal joints of the palpi often show beyond the tip of the rostrum, almost in the central line. Dorso-vertex slightly domed, leaving a somewhat depressed band between it and the abdomen. Lamellar hairs persisting on the anterior edge of the dorso-vertex although there are not any lamellæ. Pseudo-stigmata small, dorsal, near together. Pseudo-stigmatic organs long, standing upward or slightly recurved; and having long, slender peduncles, and short, *slightly lanceolate heads*. Interlamellar hairs very small and fine. No tectopedia; but there is a chitinous shelf on each side carrying the first leg, and slightly cleft to give play to it. No opistophragmatic processes. Sternum well-marked. Apodemata joined to the sternum.

**Legs** long and *extremely fine*, joints mostly clavate; but the legs are not so long, nor the joints so clavate

\* *Nitens*, shining.

as those of many other species of the genus. Claws monodactyle. Tactile hairs on all the legs. Coxæ of third pair of legs approximately globular, the fine, proximal ends of the femora inserted under the coxæ; each of these coxæ bears a straight, horizontal spine pointing outward, as in *Notaspis bipilis*, but much smaller, and a fine flexible hair below it. There is a whorl of fine, curved hairs near the distal end of each of the three central joints of each leg. The tarsi are sparsely clothed with very fine hairs.

**Abdomen** a short oval, very rounded anteriorly, but with a slight tendency to be pointed posteriorly. Notogaster highly polished, without any markings; the central part of the progaster has a tendency to fade into the cephalothorax. The notogaster bears a row of about five long, filiform, slightly-curved, white hairs along each side, some distance within the lateral margin; a pair of similar hairs on the same transverse line as the third pair of lateral hairs, but nearer the median line of the body; and a pair of smaller hairs at the posterior end, lower in level. All these hairs are found to be imbricated if seen by a high power (say 500 diameters). Genital and anal plates far apart, the former small and square, the latter more pentagonal. There is a small, tooth-like projection of the ventral plate between the third and fourth pairs of legs.

*Nymph.*

**Colour** almost white, with a greenish-grey tinge. Tip of rostrum and legs pinkish, both colours very light; whole body translucent.

**Texture** finely punctured, smooth but not polished.

**Shape** long pyriform.

**Cephalothorax.**—Rostrum slightly bifid anteriorly, from the mandibles generally showing; plainly divided from the remainder of the cephalothorax by a constriction, so as to look like a caput. Palpi long, very mobile,

standing free. Cephalothorax behind the rostrum arched in the middle, but with a depressed antero-lateral margin carrying the first pair of legs, at the insertion of which the width increases suddenly from the rostrum, afterwards it increases gradually in the same line as the abdomen. Rostral hairs near together, rather dorsal; a similar pair, somewhat larger, at the posterior line of the rostrum. Pseudo-stigmatic organs very rough, looking almost as if jointed; long, gradually thickened towards the distal ends, and pointing upward, outward, and slightly backward. Interlamellar hairs long, straight, slightly serrated.

**Legs** long, thin, of nearly even thickness throughout; coxæ, except of fourth pair, plainly seen. Tactile hairs on all legs, but short. A whorl of curved hairs on genua and tibiæ of two front pairs, and similar hairs on the outside of most other joints except the tarsi; all these hairs are slightly serrated. Tarsi with fine hairs.

**Abdomen** truncated anteriorly, rounded posteriorly. Notogaster arched, and usually with two irregular depressions near the progaster, and sometimes some others. There are two crosslines like segmentations. A row of about five very long curved hairs along each lateral margin, three similar pairs on the notogaster, and two smaller pairs, one below the other, on the hind margin; all these hairs are slightly serrated.

**Distribution.**—This species is often found in moss, but its chief habitat is old decaying wood. It has been recorded in Germany.

If a few of this species be put living in a glass cell with a small piece of the wood and a scrap of cheese, and covered with a glass cover, they may be very easily reared. They pass through all stages of their life-history very rapidly in summer, and I have kept successive generations alive in the same cell for over twelve months.

## DAMÆUS VERTICILLIPES,\* Nic., Pl. XXXVII.

*Damaeus verticillipes*, Nic. P. 462, pl. viii, fig. 2.  
*Nothrus pollinosus*, Koch. Heft 29, pl. xii, ?.

Average length about ·36 mm.

Average breadth about ·20 mm.

Average length of legs (first pair) about ·27 mm.

Average length of legs (second pair) about ·20 mm.

Average length of legs (third pair) about ·25 mm.

Average length of legs (fourth pair) about ·30 mm.

This species is noticeable for its moniliform legs and its habits of usually carrying its cast skins and being covered with white or grey powder. It is very variable, both in size and in the covering of white powder. The pseudo-stigmatic organs also seem to vary in their length and the fineness of their terminations, but this depends on whether they are clean and perfect or not. I have suspected that there may be more than one species, but have not been able to define more than one, as there seem to be intermediate forms. Koch's name, being the older, ought to be preserved if we were certain that it applied to this species; but he says that all the legs are the same length, and that the pseudo-stigmatic organs have thin proximal ends and become much thicker towards their distal ends. Neither of these statements is correct for the present species, and with a more careful describer than Koch this would be fatal; but his figure makes me suspect that he may have had this creature after all; Nicolet certainly had, so it is safer to retain his name. Even he says that the pseudo-stigmatic organs are slightly thickened towards their distal ends; this appears so, as the creatures are usually caught, but clean specimens in perfect condition have them prolonged to very fine points.

**Colour** dark red-brown, legs lighter.

**Texture** smooth, but not polished.

\* *Verticillus*, a whorl; *pes*, a foot.

The whole creature is usually so covered by the cast skins, and by white or grey powder, which adheres in quantities to all the upper and lateral parts of the body, and to the legs and every hair upon them, that neither colour nor texture can be seen from the dorsal aspect ; sometimes however the powder is partly rubbed off, or the cast skins gone.

**Cephalothorax.**—Rostrum rather rounded. Rostral hairs fine and sharply curved. The cephalothorax is divided, but not very plainly, into three divisions, firstly the rostrum, then a more rounded portion deeply indented posteriorly for the insertion of the first pair of legs, and finally, a mammillated posterior part bearing the pseudo-stigmata, and having a large, rather trifid projection on each side with a sharp anterior tooth or corner, and the second leg is articulated to its hinder edge. There are not any other markings on the cephalothorax. Pseudo-stigmata near together, rather trumpet-shaped ; pseudo-stigmatic organs very long and setiform with curved or undulated ends, which in clean and perfect specimens are very fine and long ; but these ends appear often to get either broken off or matted up, and then the organ looks shorter and blunter ; indeed, it often looks as though it increased a little in thickness towards the distal end, probably from matter adhering to it. Interlamellar hairs setiform, curved, of moderate length ; there is a shorter, more sharply-curved hair on the outer side of each pseudo-stigma.

**Legs** short for the genus ; joints with thin proximal ends, and sudden almost globular enlargements, giving a very moniliform appearance. Each joint bears a whorl of sharply curved hairs. Tactile hairs on all legs and the usual hairs on the tarsi.

**Abdomen** a short oval, almost globular, rounded posteriorly ; without markings. There are projecting tooth-like points between the second and third, and between the third and fourth legs, protecting the articulations. Two stout hairs stand forward from

the progaster, and there are two longitudinal rows of moderately large, curved, flexible hairs on the notogaster. Genital and anal plates rather large, close together in the central part of the ventral plate; they are nearly square, and the genital are slightly the larger.

*Nymph.*

This so closely resembles the adult that it is only necessary to notice the differences; it is usually either entirely covered with white or grey powder, or has the powder plentifully scattered over it.

**Colour** dirty yellowish-white, rostrum and legs light pinkish-red.

**Texture** soft, dull in appearance; it is really finely reticulated; this is best seen on the larval cast skin.

**Legs** not quite so long nor so strongly moniliform as those of the adult, otherwise very similar.

**Abdomen** a trifle longer in shape than that of the adult; hairs on the notogaster longer and black. Genital and anal plates much smaller and more oval than those of adult.

**Distribution.**—Generally distributed, but not very abundant. The small, very powdery specimens I have chiefly found in Epping Forest. The species has been recorded in France (? in Germany also).

Canestrini and Berlese have described a species which they call *Belpa globipes*, it only differs from the present species in having the hairs on the notogaster larger and thicker; I have myself seen such specimens from Switzerland, it is difficult to say whether it is more than a local variety.

DAMÆUS SUFFLEXUS,\* *Michael*, Pl. XXXIV, figs. 9, 10.

*Damæus sufflexus*, Michael. Journ. Roy. Microsc. Soc., ser. ii, vol. v, p. 10.

Average length about .65 mm.

Average breadth about .40 mm.

Average length of legs (first pair) about .62 mm.

Average length of legs (second pair) about .52 mm.

Average length of legs (third pair) about .56 mm.

Average length of legs (fourth pair) about .70 mm.

This species is remarkable for the great extent to which the dorsal plate of the abdomen is turned over on to the ventral surface posteriorly, and the consequently small size of the ventral plate.

**Colour** dark hazel-brown.

**Texture** dull, without any gloss ; that of the cephalothorax and legs rather rough.

**Form.**—That of the typical species of the genus (as *D. clavipes*, *D. geniculatus*, &c.).

**Cephalothorax.**—Rostrum rather long, rounded at the tip, and having a slight median carination which extends halfway along the cephalothorax. There is a rounded boss on the dorsum on each side, beyond the outer edge of which the first leg is articulated. Behind these bosses the cephalothorax is sharply constricted, the constriction, however, being narrow and shallow. Behind this constriction there is a larger boss on each side, beyond the outer edge of which the second leg is articulated ; these posterior bosses carry the pseudo-stigmata ; behind the bosses the cephalothorax is again narrowed, but less sharply. Rostral hairs strongly curved, rather thick. There are a pair of much larger similar hairs corresponding to the lamellar hairs, but there is not any trace of a lamella. Pseudo-stigmata long, very projecting, and standing nearly upright, the outer edge light-coloured. Pseudo-stigmatic organs long, rod-like, or filiform.

\* *Sub*, under ; *flecto*, I bend.

**Legs** long and thin, with clavate joints ; but neither the whole leg nor the peduncles of each joint are as long as in *D. clavigipes*. The legs are of the typical *Damæus* form, but not carried to excess. The peduncles of the front femora and the distal part of the front tarsi are, however, very thin. There is an irregular whorl of thick, sharply-curved, brown hairs on each joint except the coxae and tarsi. Each tarsus bears a large chitinous spike on its upper median line near proximal end, and a number of fine hairs.

The **Abdomen** is globose, *very* finely punctured all over the notogaster. The progaster is considerably raised above the cephalothorax. The *notogastral plate* is strongly turned over (*returned*) on to the ventral surface, particularly at the posterior margin ; it embraces the edges of the *ventral plate* which is *very small*. There is a small projection between the third and fourth pairs of legs (not visible in the plate), and there is a row of brown, chitinous, spike-like hairs round the hind margin and the hinder part of the lateral margins.

I am not acquainted with the immature stages of this species.

**Distribution.**—This creature was first sent to me by Mr. E. Bostock who found two specimens at Stone in Staffordshire. I have since found a single specimen at Keswick (Cumberland). It was found in moss on the ground in each instance. These are the only specimens I know of.

The specific name was suggested by the discoverer.

### DAMÆUS TECTICOLA,\* *sp. nov.* Pl. XXXV.

Average length about .65 mm.

Average breadth about .45 mm.

Average length of legs (first pair) about .70 mm.

Average length of legs (second pair) about .52 mm.

\* *Tectum*, a roof; *colo*, I inhabit.

Average length of legs (third pair) about .65 mm.  
Average length of legs (fourth pair) about .86 mm.

This species and the following one may, I think, fairly be considered as intermediate between *D. clavipes* and *D. verticillipes*.

**Colour** brown, of medium depth, and having the appearance of a purple bloom over it. The creature is, however, usually more or less dusted or covered with a whitish powder.

**Texture** of cephalothorax dull and roughish ; of abdomen, smooth but not polished.

**Shape**.—That of the typical species of the genus, the abdomen very globular.

**Cephalothorax** considerably less wide than the abdomen ; without any true sculpturing, but rising to broad elevations opposite the insertions of the first and second pairs of legs ; leaving a strong depression between, on each side of the body ; the central part of the cephalothorax is also considerably raised and arched, but there is a sharp depression before joining the abdomen, extending the whole width of the cephalothorax. Rostrum rather small, pyramidal. Two pairs of rostral hairs. Palpi visible. The elevation opposite the first pair of legs terminates outwardly in a small projection on each side to which the coxa of that leg is articulated ; there is a much larger projection on each side between the first and second pairs of legs ; this projection has a *strong curved point anteriorly*, and the second coxa is articulated to its posterior edge. There is a smaller projection, with a similar curved point, behind the insertion of the second pair of legs. Pseudo-stigmata much raised, near together. Pseudo-stigmatic organs long, serrated, *setiform or rod-like*, but somewhat thinner at the distal than the proximal end ; usually standing outward and slightly backward. Interlamellar hairs short, rough, and rod-like.

**Legs** long and slender with clavate joints, but not so slender nor so clavate as those of *D. clavipes*. The

coxæ of the first two pairs are very small, and the femora of these legs are turned almost at a right angle at their proximal insertion. The coxæ of the two hinder pairs are much larger, curved, and clavate. There are two large curved hairs on each coxa of the third pair; one on the thin proximal part, and two whorls on the distal part of each femur of the first two pairs, and one whorl on each other joint of each leg except the coxæ; all these hairs are *slightly serrated or imbricated*; there are also some fine straight hairs on the tarsi. The tactile hairs are not strongly developed.

**Abdomen**, as seen from the dorsal aspect, appears almost globular; the progaster is rounded, forming an unbroken curve with the rest of the periphery. The notogaster is without markings; it bears a row of about eight strong, curved, black hairs on each side, rather nearer the lateral edge than the median line; there is also a pair of similar hairs on the hind margin. All these hairs are slightly imbricated. There is a small blunt projection in front of the insertion of each third coxa, and a larger one to the anterior angle of which this coxa is articulated. When the creature has lately emerged it sometimes carries the cast skins in a small shrunken lump on the notogaster.

### *Nymph.*

This is a pretty and distinct creature, more clearly different from the immature stages of other species of the genus except *D. tenuipes*, than the adult is from some of the other imagos. The nymph has a certain resemblance to that of *Notaspis bipilis*.

**Colour** very light flaxen, or yellow-brown; rostrum and legs pinkish.

**Texture** highly polished, semi-transparent.

**Shape** longish-pyriform, with a bifid, posterior, central point.

**Cephalothorax**.—Rostrum small, the point slightly

rounded, rostral hairs sharply curved. Cephalothorax suddenly enlarged behind the rostrum, very round in outline, and arched. Pseudo-stigmata small. Pseudo-stigmatic organs rather long, curved, setiform, often covered with particles of extraneous matter which alter their apparent shape. Interlamellar hairs fine, shorter than the pseudo-stigmatic organs.

**Legs** longish, but not long for the genus, very slender, of nearly even thickness throughout; the joints, except the tarsi and anterior coxae, being very slightly enlarged towards their distal extremities. Each of the three central joints of each leg bears a whorl of fine, curved, black hairs near its distal end. The tarsi are furnished with fine straight hairs. The tactile hairs of the first pair of legs are large.

**Abdomen** oval. Progaster rounded, notogaster smooth, without markings. It has a decided posterior bifid point, from each division of which springs a long, curved, setiform hair, directed backward and outward. There are a pair of large, flexible, black hairs near the centre of the progaster, and a line of about six similar hairs along each side, some way within the periphery. The cast skins of the earlier stages are carried on the posterior half of the notogaster, and form a small, shrunken, shield-shaped patch, which looks white, rough, and granular, in consequence of wrinkling; each of the cast skins has its line of black hairs, often much twisted and broken.

The **Larva** is almost colourless, but with a slight grey shade; it is semi-transparent, and a slight yellowish shade is seen where the light passes through the body. The posterior margin of the abdomen is blunter than in the nymph, and of course the larva does not carry any cast skins, but it is apt to collect white powder and dirt on the notogaster. The hairs are black and very long.

The **Egg** is light yellow-brown, long in shape, and small at the ends. It has a deutovium stage. I have

found them twisted in the mycelium in which the parents lived, and this was the position the eggs were deposited in when laid in my cells.

**Distribution.**—The first place where I found this species was in the thatch of an old cottage in Warwickshire, which was being pulled down. I have since found a few individuals in the New Forest. I am not aware that it has ever been recorded elsewhere. I found several specimens in the thatch.

### DAMÆUS TENUIPES,\* *Michael*, Pl. XXXVI.

*Damæus tenuipes*, Michael. Journ. Roy. Microsc. Soc., ser. ii, vol. v, p. 395.

Average length about .67 mm.

Average breadth about .45 mm.

Average length of legs (first pair) about .77 mm.

Average length of legs (second pair) about .67 mm.

Average length of legs (third pair) about .84 mm.

Average length of legs (fourth pair) about 1.34 mm.

This species has a strong resemblance to *D. tecticola*, but does not appear to be identical. The principal differences are, firstly, that the legs of the present species are considerably longer in proportion, and more slender; secondly, that the pseudo-stigmatic organs of *D. tecticola* are long and setiform, gradually diminishing to a point, whereas those of the present species are thickest near the distal end (the shape is described below); thirdly, that the chitinous projection between the first and second leg has a strong anterior curved point in *D. tecticola* which is absent in the present species; and fourthly, that the hairs on the notogaster gradually diminish in length in the present species from the progaster to the hind margin, whereas in *D. tecticola* the posterior hairs are as long as the anterior.

**Colour** brown, of medium depth, and having the

\* *Tenuis*, slender; *pes*, a foot.

appearance of a purple bloom over it. The creature is, however, usually more or less dusted or covered with a whitish powder.

**Texture** of cephalothorax dull and roughish, of abdomen smooth, but not polished.

**Shape.**—That of the typical species of the genus, the abdomen very globular.

**Cephalothorax** considerably less wide than the abdomen, without any true sculpturing, but rising to broad elevations opposite the insertions of the first and second pairs of legs, leaving a strong depression between on each side of the body. The central part of the cephalothorax is considerably raised and arched, but there is a sharp depression before reaching the abdomen, extending the whole width of the body. Rostrum rather small, pyramidal. Two pairs of rostral hairs. The elevation opposite the first pair of legs terminates outwardly in a small projection on each side, between the first and second pairs of legs; this projection *is rounded and without any point anteriorly*; the second coxa is articulated to its posterior edge. There is a smaller projection, with a curved anterior point, behind the insertion of the second pair of legs. Pseudo-stigmata much raised; near together. *Pseudo-stigmatic organs rather short for the genus, with rod-like peduncles of even thickness throughout, suddenly increased in thickness, and continuing the increased diameter until near the point, so that they have the appearance of bearing an elongated cap or pileus; they stand outward and usually slightly forward. Interlamellar hairs short, rough, and rod-like.*

**Legs** very long and slender, with fine clavate joints. The coxae of the first two pairs are very small, and the femora of these legs are turned almost at a right angle at their proximal insertion. The coxae of the two hinder pairs much longer, curved, and clavate. There are two large curved hairs on each coxa of the third pair, one or two on the thin proximal part of each femur of the first two pairs, and one whorl on this and

each other joint of each leg ; all these hairs are *slightly imbricated*. There are also some fine straight hairs on the tarsi. The tactile hairs are not strongly developed.

**Abdomen**, as seen from the dorsal aspect, appears almost globular. The progaster is rounded, forming an unbroken curve with the rest of the periphery. The notogaster is without marking ; it bears a row of about eight strong, *almost straight*, black hairs on each side, *which diminish in length from the progaster to the hind margin*. There is also a pair of hairs on the hind margin itself ; all these hairs are slightly imbricated. There is a small blunt projection in front of the insertion of each third coxa, and a larger one, to the anterior angle of which this coxa is articulated. The creature sometimes carries the cast skins as a small shrunken lump on the notogaster.

### *Nymph.*

This creature is so like the nymph of *D. tecticola* that it appears unnecessary to repeat the description. The differences are, firstly, that the legs of the present nymph are the longer, secondly, that the pseudo-stigmatic organs exhibit the same differences in form as the adults ; thirdly, the present nymph is more colourless than that of *D. tecticola* ; and fourthly, the cast skins are carried, not flat on the back or crumpled, but in a pile, each skin preserving its original form, so that they look like a diminishing series of dish-covers, and they show the reticulation strongly. In the centre of the notogaster is a long process of the cuticle, thicker than an ordinary hair, which supports the lowest cast skin ; from this skin springs a similar process, which supports the second, and so on ; thus they form a continuous pillar supporting the cast skins, but entirely hidden unless the transparency of the skins allows them to be seen through.

**Distribution.**—I have only found this species in the thatch of an old roof near the Land's End, Cornwall. The similarity of habitat and of the nymphs raises a suspicion that this species is only a variety of *D. tecticola*, but the different length of legs, and the entirely different pseudo-stigmatic organs, seem to preclude their being so treated.

DAMÆUS CLAVIPES\* (*Herm.*). Pl. XXXVIII; Pl. D, figs. 6, 7; Pl. E, fig. 5; Pl. G, fig. 12.

*Notaspis clavipes*, Herm. P. 88, pl. iv, fig. 7.

*Damæus nodipes*, Koch. Heft 30, fig. 6.

— *concolor*, — Heft 36, fig. 6 (?).

— *auritus*, Nic. P. 462, pl. viii, fig. 3.

*Belba geniculata*, Can. e Fan., p. 33 (this applies also to *D. geniculatus*).

*Oppia glauquina*, Koch. Heft 3, fig. 9. Probably nymph of this species.

Average length about 1·05 mm.

Average breadth about .70 mm.

Average length of legs (first pair) about 1·31 mm.

Average length of legs (second pair) about 1·14 mm.

Average length of legs (third pair) about 1·25 mm.

Average length of legs (fourth pair) about 1·80 mm.

This species has doubtless been confused with *D. geniculatus* by almost all of the earlier, and even by some of the later writers (see observations heading the description of *D. geniculatus*). It is nevertheless very distinct, having the joints of the legs much longer, and more slender, the peduncular portion of each joint being longer, and the club shorter and more distinctly marked off. The whole creature is smaller and slighter, and there are other differences.

**Colour.**—When the adult has lately emerged it shows a purplish bloom, and is not dark; older specimens

\* *Clava*, a club; *pes*, a foot.

become browner and darker. Legs lighter than the body.

**Texture** smooth but not polished ; the creature has a powdery appearance, and is often more or less covered with what looks like short matted white cotton ; this is really some portion of the nymphal skin. It occasionally also carries more or less dirt.

**Cephalothorax** distinctly divided into three divisions by transverse furrows or constrictions ; the central division is shorter, from anterior to posterior margin, than the others. The anterior division is considerably the narrowest ; it forms the rostrum, and is conical, with a rounded apex ; it is without markings, but the lower edge (epistome) of the antero-lateral portion slightly projects. There are a pair of small, curved, rostral hairs, and a considerably larger pair on the dorsal surface of the rostrum. The central division has a large, projecting and raised, rectangular, chitinous piece on each side, to the outer edge of which the first leg is articulated ; near the inner edge of this piece is a sharp longitudinal furrow. Between these two pieces this division of the cephalothorax is somewhat arched, and bears two not very plainly-marked longitudinal ridges. The posterior division is the broadest. The pseudo-stigmata, which are very projecting tubes, are placed near its anterior margin on the tops of mammilliform elevations. Pseudo-stigmatic organs *filiform*, of moderate length, *not so long as those of D. geniculatus*. Interlamellar hairs short, setiform, sharply curved. There are two very short similar hairs, one on the outer side of each pseudo-stigma and quite close to it ; these, however, are not easily seen. Behind the mammilliform elevations are four short longitudinal ridges, not quite reaching the abdomen. At each side of this division, between the first and second leg, is a strong chitinous projection, *much longer and narrower and much more pointed anteriorly than the similar part in D. geniculatus* ; the anterior portion projects most, and the anterior edge is considerably excavated to give play to the femur

of the first leg. The outer edge is distinctly divided into three lobes, of which the anterior is much the largest. The second leg is articulated immediately behind the projection, and behind this leg is a very much smaller tooth-like projection.

**Legs** *extremely* long and thin. The femora of the first and fourth pairs, the tibiæ of the fourth pair, and the tarsi of all the legs are of remarkable length and tenuity. The coxæ of the two hind pairs of legs are large, and each has a sort of projecting blade on the posterior lower edge. The femora have slender peduncles and clavate heads, *which are sharply marked off from the peduncles*. The peduncles of the first and fourth femora are three times as long as the heads. Genuals and tibiæ thin, slightly larger towards the distal ends. Tarsi with elongated, more or less diamond-shaped proximal portions, and long, slender, distal parts, slightly undulated near the claw. There is a whorl of thick, black, imbricated, stiff, curved hairs or spines on each of the three central joints of each leg; one similar on the peduncle of each femur, two on each coxa of the third and one on each coxa of the fourth pair, and one on each tarsus of the third and fourth pairs. There is a fine tactile hair on each tibia, not very long, and all the tarsi have fine hairs. Apodema short, not nearly reaching the sternum.

**Abdomen** almost *globular*, standing considerably above the base of the cephalothorax. There is an anterior depressed portion of some size at the antero-lateral angles; to this the two hind pairs of legs are articulated, the first being on a projection. There is a smaller, solid, blunt projection further forward, almost touching the tooth-like projection of the cephalothorax, and there are very small projections both in front of and behind the insertion of the hind coxa. There is an elliptical series of about fourteen black hairs on the notogaster, similar to those on the leg, but larger and curving outward; two pairs of finer hairs on the posterior margin, lower in level; and two

short, spike-like processes on the progaster. Nicolet describes a small, depressed, oval mark on the anterior part of the notogaster which I have not detected in English specimens. Genital and anal plates square, close together.

*Larva.*

**Colour** of the young larva semi-opaque, yellowish-white, with one or two vague orange or yellowish spots caused by portions of the alimentary canal showing through the skin. The legs and rostrum light red; all the numerous long hairs are jet black. At this stage the larva is quite clean and is a beautiful creature.

**Shape.**—As seen from the dorsal aspect the form has a tendency to be irregularly pentagonal, the cephalothorax being triangular and somewhat pointed, the abdomen somewhat square; by far the best idea is obtained, however, by a side view; it is then seen that in consequence of the long tarsi, which are carried much raised at the proximal end, the body of the creature is kept well above the ground.

**Cephalothorax.**—Rostrum sharp; it points perpendicularly downward; its posterior edge is overhung by a fold of the soft skin of the cephalothorax; the almost colourless palpi show very plainly at the side; the cephalothorax rises sharply to the level of the abdomen and has the pseudo-stigmata set in papilla-like projections which bear a dark orange-brown ring round the opening. The pseudo-stigmatic organs long, really setiform, but usually, from extraneous matter adhering to them, having the appearance of being gradually thickened towards the end; they make a double curve forward and outward, and are rough and black. Interlamellar hairs close to the pseudo-stigmatic organs and very similar to them; there is also a short hair outside each pseudo-stigma.

**Legs** very long, about twice the length of the body;

they are extremely thin, the tarsi in particular being wonderfully fine and slightly undulated in outline; they are thickened near the proximal end. The claw is large and strong.

**Abdomen.**—There are four longitudinal rows of large papillæ along the notogaster; of these the two central are considerably the largest. They arise from the strongly arched surface and therefore stand above the lateral rows of papillæ, which are also smaller; there are about five in each of the central and about four in each lateral row. There are also four large papillæ at the hind margin, an outer and upper pair and an inner and lower pair. On the ventral surface the posterior part of the abdomen is rounded so as to give an almost hemispherical outline.

The *hairs* are very long and strong, all quite black, and almost all slightly serrated. A very strong hair arises from each of the above-mentioned papillæ, the largest being those arising from the papillæ of the two central rows. Of these hairs the first pair curve forward; the second, which are the longest and reach twice as high above the body as the thickness of the latter, stand nearly upright for two-thirds of their length and then curve backwards; the other pairs are of the same shape but gradually diminish in length. The hairs springing from the four anal papillæ are very long, those on the upper and outer pairs being twice as long as the body and very flexible; those on the inferior papillæ are shorter, although still very long, and are straighter and stiffer. The tactile hairs on the front tibiæ are very long. There are a series of short curved hairs down the inside of each tarsus, whorls of hairs of medium length on the third and fourth joints, a strong spine on each femur; a very strong hair or spine on the upper part of the tarsus of the third pair, one, not so large, in the same position on the other legs; and numerous other less important hairs on the legs.

*Nymph.*

When the larva becomes a nymph not only does the fourth pair of legs appear but the different papillæ become less conspicuous ; and this process continues as the nymph grows older, until the mature nymph hardly shows any papillæ except those at the hind margin, the hairs seeming to spring almost from the surface of the notogaster. The creature moreover loses its clean appearance with age, all sorts of débris are piled upon the back and adhere to the long hairs in a permanent manner, until, although not plastered with mud like the nymph of *D. geniculatus*, it is almost as much covered ; amongst the débris which it picks up will frequently be found its own eggs or those of other creatures. The colour is a little darker than that of the larva, and the rostrum somewhat more chitinised ; the hairs, which are still very long, do not seem so long in proportion to the body. In other respects the larva resembles the nymph.

**Distribution.**—Common and generally distributed, chiefly found in moss. It has been recorded in Switzerland, Germany, France, Italy, &c.

DAMÆUS GENICULATUS (*Linn.*). Pl. XXXIX ; Pl. D, figs. 8, 9, 10, 17 ; Pl. E, figs. 4, 12, 17 ; Pl. F, figs. 1, 6, 7, 10 ; Pl. G, figs. 1, 5.

*Type species.*

*Acarus geniculatus*, Linn. System. natur., 12th ed., vol. ii, p. 1025, No. 19.  
 — — — Fauna Suec., 2nd ed., No. 1977.  
 — — — Fabricius. Entomol. System., vol. iv, p. 431, No. 32.

*Acarus geniculatus*, Schrank. Fauna boic., vol. iii, p. 208,  
No. 2666.

*Belba geniculata*, Gervais. Hist. Nat. des Insectes Aptères,  
Walckenaer, t. iii, p. 256.

— — Can. e. Fan., p. 33.

*Oribata* — Berlese. Acarofauna Sicula, 1a ser., p. 10.  
Latreille. Genera Crustaceorum et Insectorum,  
t. i, p. 149.

— — — Hist. Nat. des Crust. et des Insect.,  
t. vii, p. 400.

*Tique noir et lisse des pierres* (?), Geoffroy. Insect. des environs  
de Paris, t. ii, p. 626.

*Damæus geniculatus*, Koch. Heft 3, fig. 13.

— Nic. P. 460, pl. viii, fig. 1.

— *torvus*, Koch. Heft 3, fig. 14. Nymph (?).

Average length about 1·45 mm.

Average breadth about 1·00 mm.

Average length of legs (first pair) about 1·50 mm.

Average length of legs (second pair) about 1·20 mm.

Average length of legs (third pair) about 1·35 mm.

Average length of legs (fourth pair) about 1·75 mm.

Very great confusion has arisen over the synonymy of this species. It has been confused with *D. clavipes* by all the earlier and some later writers, and in many instances with other species also. It may be taken that Linnaeus, Fabricius, Schrank, Latreille, and Gervais, did not distinguish between *geniculatus* and *clavipes*, and probably other allied species were included. Linnaeus's description is clearly not sufficient for identification. It is " *Acarus niger, femorum geniculis subglobosis; habitat in arborum ramis emortuis.*" Fabricius simply copies Linnaeus. Latreille and Geoffroy identify the latter's "*Tique noir et lisse des pierres*" with Linnaeus's *A. geniculatus*, otherwise the identity might well be doubted. Latreille and subsequent writers copying him also identify the Linnaean species with *Notaspis clavipes* of Hermann, but that author, although his descriptions are imperfect, had a knack of drawing his creatures so as to be very characteristic, and his species is certainly not the one now usually known as *geniculatus*, and which probably was the Linnaean species. Another serious element of

confusion arose from the early writers identifying the Linnæan species, and also Hermann's species, with the *Acarus corticalis* of de Geer, a creature which does not in any way resemble it, and which certainly is a *Notaspis*, using that name in the present limited sense instituted by Nicolet (not in Hermann's sense), and not a *Damæus* as Hermann's *D. clavipes* is; de Geer himself identifies his species with Geoffroy's, and Latreille identifies Geoffroy's with Linnæus's and Hermann's. Thus it came to be taken for granted that they were identical, whereas in reality they are probably all different; Hermann's and de Geer's are certainly widely different. It is remarkable that de Geer saw and figured the triple claw, which is not specially easy to see, even in a modern microscope.

C. L. Koch was probably the first author who really saw that there was more than one species of *Damæus*. I do not see any reason to doubt that his *D. geniculatus* was the species which Nicolet called by the same name, and to which it is ordinarily applied at present. Koch, however, follows earlier writers in identifying Hermann's *D. clavipes* with *D. geniculatus*, although he seems to me probably to have found Hermann's species, and seeing that it was probably different, but not recognising it as Hermann's, he calls it *D. nodipes*. He does not fall into the error of identifying it with de Geer's species.

Nicolet commences his notice of Hermann's species by saying that the two have been confused together and that he has separated them, and it would be thought that he had paid special attention to the subject; his figures and drawings are quite sufficient for identification, but when we come to the synonyms we find confusion worse confounded; he has copied all the mistakes of the earlier writers, and has transferred all the names prior to Koch to Hermann's *N. clavipes*, which he calls *D. auritus*, whereas if it were, as he says, Linnæus's species, he clearly should have called it *geniculatus*. He also drops Hermann's name of *clavipes*,

and uses the name of *auritus*, a name which he takes from a totally distinct species of Koch's, which, for some reason which is entirely beyond my comprehension, he christens *riparius*, although he expressly and correctly states that it is Koch's *auritus*. Nicolet starts the synonymy of his *D. geniculatus* with Koch, whose name he puts after the species; whereas it is manifest that if Koch's species had been different from Linnæus's, then the name should have been retained for the species of the earlier not the later writer; and, oddly enough, Nicolet also gives Koch's *D. geniculatus* as a synonym of *D. clavipes* (Nicolet's *auritus*). Finally, Canestrini and Fanzago, notwithstanding Nicolet's exposition of the difference of the species, treat *geniculatus* and *clavipes* as identical, but they call it *Belba geniculata*, they and some other writers considering that Heyden's name of *Belba* should be used instead of Koch's later name of *Damæus*, but Heyden founded his genus upon the type of *Notaspis corynopus*, Hermann, which is not a *Damæus* at all.\* It may possibly have been supposed to be a *Damæus* because Hermann drew it with a monodactyle claw; he makes several errors as to the claws, which was only natural when we remember the date at which he wrote.

This is probably the largest species of the British *Oribatidæ*.

**Colour** very dark brown or black, legs a trifle lighter.

**Texture** dull, very slightly rough; this is hardly seen in the living specimen; the roughness is entirely produced by small wart-like projections of the epios-tracum. In the prepared specimens this layer separates very readily and then these markings are very clearly seen, on some parts of the creature, particularly on the proximal joints of the legs, they are elongated so as to form short, filiform processes, which, however, are apt to be partially rubbed off, and indeed the epio-

\* At vol. i, p. 33, I have accidentally put down *Belba* as equalling *Damæus*, Koch, and part of *Oppia*, Koch, which is a slip. It does not equal *Damæus*, although they are generally treated as identical.

tracum itself is often partially lost. The creature generally carries more or less dirt.

**Cephalothorax** distinctly divided into three divisions by transverse furrows or constrictions. The anterior division is considerably the narrowest ; it forms the rostrum, and is conical with a rounded apex ; but the lower edge (epistome) of the antero-lateral portion slightly projects. There are a pair of small, curved, rostral hairs, and a considerably larger pair on the dorsal surface of the rostrum. The central division has a somewhat projecting and considerably raised chitinous boss on each side, to the outer edge of which the first leg is articulated. There is a curved ridge near the inner side of each boss, and nearer the median line are two straight ridges which almost touch anteriorly but are widely separated posteriorly ; they enclose a triangular depressed space which has an indication of a carination in the median line. The posterior division has a similar triangular median depression bordered by ridges but without any carination. The pseudo-stigmata are placed near the anterior margin of this division on the tops of mammilliform elevations ; they are *very* projecting, with open trumpet-shaped mouths and are strongly ridged inside ; if dissected out they are seen to be cornucopia-shaped. Pseudo-stigmatic organs *filiform*, rather long. Interlamellar hairs filiform, curved or straight, varying in length, set close to the inner anterior edges of the projections which carry the pseudo-stigmata ; there is a much smaller hair outside the pseudo-stigma. At each side of this division, between the first and second leg, is a strong chitinous projection which has a blunt-pointed, tooth-like anterior, and a rounded posterior lobe. The second leg is articulated immediately behind this projection.

**Legs** long but not so long in proportion as in some other species ; they are rather thick for the genus. Coxæ of the two hind pairs of legs large, and each has a sort of projecting blade on the posterior lower edge.

The femora gradually thicken from the proximal until near the distal ends, the heads being indistinctly marked off from the peduncles. Genuals and tibiæ slightly enlarged toward the distal ends. Tarsi with pedunculated, more or less diamond-shaped, proximal parts, and rod-like distal portions, slightly curved at the ends, but not very thin nor long. There is a whorl of thick, black, stiff, slightly serrated, curved hairs or spines on each of the three central joints of each leg; three on the peduncle of each front, and one on that of each hind femur; two on each coxa of the third, and one on each of the fourth pairs: there is a fine, but short, tactile hair on each tibia and the usual fine hairs on the tarsi.

**Abdomen** slightly *pyriform*, not truncated; standing considerably above the base of the cephalothorax. There is an anterior depressed portion, of some size, at the antero-lateral angles; the outer edge of this is cut into three large teeth, between the first and second of which the third leg is articulated, and a rounded posterior lobe to which the fourth leg is articulated. There is an elliptical series of about eighteen black hairs on the notogaster *similar to those on the legs but larger*, curving outward and backward, a pair on the posterior margin and two spike-like processes near the pro-gaster. Genital and anal plates nearly square, near together. The chitinous piece inside the anal plates very large and strongly marked.

### Nymph.

This may probably be the creature described by Koch under the name of *Damæus torvus*. Nicolet was of opinion that it was. Koch's drawing appears to have the abdomen rather long and the legs rather short for the nymph of *D. geniculatus*, and Koch would not often find one so clean to draw; still, probably this was the creature.

**Colour** pale yellow or yellowish-white; rostrum and legs red or pinkish. Almost the whole dorsal surface is ordinarily concealed by a great, almost globular, mass of mud and débris.

**Texture** leathery.

**Cephalothorax** rather small. Rostrum curved downward, pointed. Rostral hairs curved, thick, black. There are another pair of larger similar hairs on the frons, doubtless the homologues of those of the adult. Pseudo-stigmata very projecting and cup-like. Pseudo-stigmatic organs long, filiform, doubly curved, *i. e.* with a tendency to an S-shape.

**Legs** long, but not specially so for the genus; first three joints of about even thickness throughout; tibiæ slightly clavate; tarsi with inversely ovate proximal and elongated distal ends (they are somewhat foreshortened in the drawing); each joint bears an irregular whorl of stiff, almost straight spines, of which the outer are the longest.

**Abdomen.**—The dorsal portion of this part of the body is usually entirely hidden by the dirt with which it is coated; when clean it is seen to be much arched, somewhat oval, and to have two very small points posteriorly from which spring long flexible jet-black hairs; there are two longitudinal rows of similar hairs on the notogaster not quite so long, and some round the edge, and a long, flexible, almost median process of the cuticle, which is not exactly a hair but rather thick at the base.

### *Larva.*

Similar to the nymph, but of course hexapod; it is almost colourless, and the black hairs on the notogaster are much larger in proportion to the size of the creature than in the nymph. See Fig. 3, where it is shown in the act of escaping from the egg. This drawing shows how the long legs and hairs are packed. The larva is figured by Haller, 'Zeit. wiss. Zool.,' Bd. xxxiv,

Taf. xi, fig. 8 (1879). I never saw the larva carrying so much dirt as in his figure.

*Egg.*

With a very hard chitinous shell, much punctured. There is a very strongly marked deutovium stage (Fig. 4).

**Distribution.**—This is one of the common and generally distributed species ; it has usually been considered the commonest. I think this must arise from its being of large size and easily seen, as there are other species more abundant, although this is very common ; it is found in moss, dead leaves, dead wood, under stones, under the bark of trees, &c., and has been recorded in Sweden, Germany, Switzerland, France, Belgium, Italy, &c., and from Port Clarence (Kramer and Neumann, ' Report on the Acari of the Vega Expedition ').

DAMÆUS AURITUS,\* Koch. Pl. XL.

*Damæus auritus*, Koch. Heft 2, fig. 11.

— Haller. Millbenfauna Würtembergis, p. 307.

*Oribata aurita*, Gervais. Hist. Nat. des Insectes Aptères, t. iii,  
p. 257.

*Damæus riparius*, Nic. P. 461.

Average length about .85 mm.

Average breadth about .58 mm.

Average length of legs (first pair) about .95 mm.

Average length of legs (second pair) about .77 mm.

Average length of legs (third pair) about .97 mm.

Average length of legs (fourth pair) about 1.25 mm.

This species is not the *Damæus auritus* of Nicolet. That writer had a strange habit of shifting the names of species, which is very confusing ; he gave the old name of *auritus* to *clavipes*, and invented a new name, *riparius*, for this species.

\* *Auritus*, eared.

The creature is very like *D. geniculatus*, but easily distinguished from it by the small, fine, hooked hairs on the notogaster, instead of the great, nearly straight, stiff spines of that species.

**Colour** very dark brown or black; legs a trifle lighter.

**Texture** dull, very slightly rough; the whole of the remarks found under the head "texture" in the description of the adult *D. geniculatus* (p. 431) will apply to the present species equally well; all specimens of *D. auritus* which I have seen carry some portions, or the whole, of their cast nymphal skins in addition to dirt.

**Cephalothorax** distinctly divided into three divisions by transverse furrows or constrictions. The anterior division is considerably the narrowest; it forms the rostrum, and is conical, with a slightly rounded apex; but the lower edge (epistome) of the antero-lateral portion slightly projects. There is a pair of small, curved, rostral hairs, and a considerably larger pair on the dorsal surface of the rostrum. The central division has a projecting and raised chitinous boss on each side, to the outer hind edge of which the first leg is articulated, and which has a projecting, slightly bifid corner anteriorly. There is a curved ridge near the inner side of each boss, and four straighter ridges between them separated by furrows; these markings are not always very clear. The posterior division has four similar ridges; all the ridges are often indistinct. The pseudo-stigmata are placed near the anterior margin of this division on the tops of mammiform elevations; they are *very* projecting, with open trumpet-shaped mouths, and are strongly ridged inside. Pseudo-stigmatic organs *filiform*, slightly thickened towards their proximal ends, long, almost straight. Interlamellar hairs thick, sharply curved, set close to the inner anterior edges of the projections which carry the pseudo-stigmata; there is a smaller similar hair on each side outside the pseudo-stigma. At each side of this

division, between the first and second leg, is a strong chitinous projection, rather more marked than that of *D. geniculatus*, having a sharp tooth-like anterior, and a blunt posterior process. The second leg is articulated immediately behind this projection.

**Legs** slightly longer in proportion than those of *D. geniculatus*, rather thick for the genus. Coxæ of the two hind pairs of legs large, each with a small projecting blade on the posterior lower edge. Femora gradually thicken from the proximal until near the distal ends, the heads being indistinctly marked off from the peduncles but still being a trifle more distinct than in *D. geniculatus*. Genuals and tibiae slightly enlarged towards the distal ends. Tarsi with pedunculated, more or less diamond-shaped, proximal parts, and rod-like distal portions slightly curved or undulated at the ends. There is a whorl of thick, black, stiff, serrated curved hairs or spines on the ends of each of the three central joints of each leg; one on the peduncle of each femur of the two front pairs; two on each coxa of the third, and one on each coxa of the fourth pair. There is a fine but short tactile hair on each tibia and the usual fine hairs on the tarsi.

**Abdomen** almost hemispherical or slightly pyriform. Nicolet says that the progaster is truncated and sinuated, which I have not observed in the English specimens; it stands considerably above the base of the cephalothorax. There is a rather large anterior depressed portion at the antero-lateral angle; the outer edge of this is cut into three blunt teeth, almost undulations, between the first and second of which the third leg is articulated, and a small, rounded, posterior lobe to which the fourth leg is articulated. There is an almost elliptical series of about eighteen *short, fine, very sharply curved, almost hooked hairs* on the notogaster, which in shape are much like the claws, but thinner; the first pair stand forward, over the cephalothorax, the others are directed backward; many specimens show a slight indication of a ridge on the abdomen outside the line

of hairs. Nicolet mentions three short ridges near the progaster which I have not seen on the English specimens. Genital and anal plates close together and very large, occupying almost the entire length of the ventral plate. Genital plates nearly square, much broader than the anal plates, which are oblong. There are a few fine hairs on the reflexed surface of the dorsal plate seen from the ventral side, and on the ventral plate.

*Nymph.*

I am not able to distinguish this nymph from that of *D. geniculatus*; it carries the dirt in the same way; it is of course smaller, but as this depends on age it is not a guide.

**Distribution.**—My specimens have come from the Midland Counties; I have not found it commonly. I believe, however, that it is pretty generally distributed but is apt to be overlooked from its similarity to *D. geniculatus*. It has been recorded in France and Germany.

## GENUS—HERMANNIA,\* Nic.

Equals part of *Nothrus*, Koch.

Equals *Hermannia* and part of *Nothrus*, Berlese.

Equals *Hermannia*, Canestrini.

*Apterogasterinae* with cephalothorax anchylosed to abdomen; without lamellæ; with abdomen round, elliptical, or oval, notogaster arched; cuticle of adults fully chitinised, and short thick legs with almost cylindrical joints. (All species at present known are monodactyle.)

This genus was originated by Nicolet in his laudable effort to break up the ill-defined genus *Nothrus* of Koch into more harmonious groups. Nicolet's type, which seems to me excellently selected, is *H. picea* (his *crassipes*). Nicolet gives the short tabular definition of his genus, which will be found at page 53 of this book, and also a more detailed definition at page 468 of his work, in which he prominently puts forward the elliptical and greatly arched abdomen. The discovery and examination of numerous species, not known to Nicolet, in other genera of the family has shown that the question of monodactyle or tridactyle claws has not the value which Nicolet attached to it (see this book page 56, and also the Appendix), but his type species and most of his other definitions remain valid. Since Nicolet's time one or two *Nothri* have been found with monodactyle claws, and it becomes rather difficult to define the difference between *Hermannia* and *Nothrus* in words, particularly as there is one species, *H. bistrigata*, which, as Berlese correctly says, is a bridge joining the two; but I think, looking to the type species and to the parts of Nicolet's definition which subsequent discoveries have not affected, that we may fairly say that the elliptical or almost round abdomen of *Hermannia*, rounded posteriorly, with its

\* Named in honour of Hermann, the Swiss arachnologist.

*strongly arched notogaster*, as contrasted with the oblong or rhomboid abdomen, truncated posteriorly, of *Nothrus*, with its raised edges to the notogaster and its central portion depressed, or only slightly raised, is the true distinction, and practically divides the two into natural groups. Berlese has attempted to define the difference between the two genera,\* but I confess that he seems to me to have been singularly unfortunate in his results; nor can I think that his method is justified by the practice of zoologists; indeed I believe that it would cause great confusion if it were adopted. He states that the reliance upon tridactyle and monodactyle claws should be abandoned, in which I quite agree with him; but he proceeds to say that there are not any differences between *Nothrus* and *Hermannia* except two, viz. 1st, that in *Nothrus* the body has a prismatic, and in *Hermannia* a globose form; 2nd, that in *Nothrus* the genital aperture is near the anal, and in *Hermannia* these apertures are distant from each other. Having thus entirely altered Nicolet's definition of his genus, Berlese says that Nicolet's type species of *Hermannia* is a *Nothrus* and not a *Hermannia*, and quietly transfers it to *Nothrus*. This would upset the whole of the good that Nicolet did in dividing the last-named genus, and leave matters in worse confusion than they originally were; because *H. picea*, the species transferred, is most distinctly a creature which should be classed with *H. arrecta* and *H. granulata* (a foreign species), and which apparently is only separated from them because the genital and anal plates are rather nearer together in *picea* than in the other two species. This character of the distance between the genital and anal plates is one which I considered very carefully when I was forming my own classification of the family. I had hoped to utilise it in defining genera, but the result of my investigation was that I felt compelled to abandon that idea, becoming convinced that this character had only a specific value. Possibly a better instance of this

\* "Acari, &c. Ital.," Notes, fasc. iii, p. 4.

could not well be found, than the fact that treating them as generic has led Berlese to transfer *H. picea* to *Nothrus*, particularly as he has been forced to do so in defiance of the rest of his own definition, for *picea* has the most globose body of all the known *Hermanniae*.

I fully agree with Berlese that *nanus* is a *Hermannia* not a *Nothrus*; as to *bistriata*, however, I am inclined to allot it to the *Hermannia* end of the bridge, rather than to the *Nothrus* end; but opinions may well differ, and no assistance can be gained from Nicolet on this point, as he erroneously supposed it to be a young form of *Nothrus palustris*.

The **Texture** is hard, rough, and dull in all known species.

The **Rostrum** usually blunt and heavy, sometimes with a tendency to be trifid, it is not sharp-pointed in any species which I know. The rostral hairs vary, but are generally rather thick. The lamellar hairs are generally large, although there are not any lamellæ.

The **Labium** is usually rather short and broad, scarcely covering half the camerastomum; it has a small median point; it is not generally prolonged forward to form a ligula (Pl. XLI, fig. 3; Pl. XLIII, fig. 9).

The **Palpi** are generally rather short and thick, the second joint being often considerably thickened (*H. reticulata*; see also *H. picea*, Pl. XLI, figs. 3, 4). The first joint is also generally thick; the fifth shorter than usual.

The **Maxillæ** are generally large, powerful, and deeply dentate (*H. picea*, *H. reticulata*). In *H. nanus* they are long, but not so deeply dentate.

The **Mandibles** are ordinarily rather short (*H. picea*), but powerful, and with rather numerous and well-formed teeth; in *H. nanus*, however, they are weak, and slight in their dentition.

The **Lingua** is well developed.

The **Pseudo-stigmata** are generally rather small and dorsal, not projecting much. The pseudo-stigmatic organs vary considerably in different species.

The **Lamellæ** are absent or quite rudimentary.

The **Tectopedia** are scarcely indicated.

The **Apodemata** are very strong and well marked, and are joined to the sternum in all known species.

The **Opisthophragmatic** processes are absent.

The **Legs** are short, the fourth pair usually scarcely passing the hind margin. They are thick and solid, sometimes very much so (*H. picea*), and are generally more or less regularly diminished in thickness from the middle of the femur onward, when seen from above. The coxæ of the third pair are generally nearly hemispherical and projecting; they may be hidden under the abdomen (*H. arrecta*). The two front pairs of femora are broad joints, rather flattened, and generally with rather thin, short, proximal ends turned almost at right angles. The genua are longer in proportion than in most genera, often as long as the tibiæ. The tarsi are generally rather long, thick, straight, and blunt-ended. The claws are monodactyle in all species known at present.

The **Abdomen** is usually a short ellipse, rounded posteriorly, and generally rounded anteriorly, but somewhat truncated in *H. nanus* and *H. bistrigata*, in both of which species the shape of the abdomen is longer. The notogaster is always arched, generally very strongly (*H. picea*, *H. arrecta*), and has not any raised margin. This arching of the notogaster forms, as above stated, the leading character of the genus.

The **Genital and Anal Plates** are large; the former always square, the latter so in *H. arrecta* and *H. nanus*, oblong in other British species. In *H. nanus* they are distant from each other (from the long shape of the abdomen); in *H. arrecta* they are much closer, but are still separated (Pl. XLIII, fig. 9); in *H. picea*, *H. nodosa*, and *H. bistrigata* they are almost touching.

The **Tracheal** system is most imperfectly developed in this genus; in *N. arrecta* I have succeeded in tracing the small cephalothoracic tracheæ, although they are very small and delicate, but I failed to find any of the

abdominal, which are usually the great tracheæ. I did not succeed in finding any tracheæ at all in *H. picea*.

The **Cæca** of the ventriculus seem to vary a good deal in different species; in *H. arrecta* (Pl. E, fig. 1) they are almost globular; in *H. picea* they are much more elongated and sausage-like.

The **Ovipositor** is short and thick, but neither so short nor so thick as in *Damæus*.

The expulsive vesicles attain a great development in this genus; in *H. arrecta* and *H. granulata* they discharge through chitinous tubular projections from the sides of the abdomen; in *H. picea* and *H. bistriata* through pores placed rather more dorsally.

The **Hairs**, both those on the abdomen and on the legs, and also the lamellar and interlamellar, have a tendency to become thick and rod-like in this genus, or spatulate, sometimes broadly so (Pl. XLI, fig. 9).

The creatures of this genus are widely distributed, but not specially abundant. They are found chiefly in dead wood, moss, &c.; and the adult of *H. nodosa* and the nymph of *H. bistriata* appear to be amphibious and to thrive equally well on land or on *Sphagnum* or *Algæ* under fresh water.

The **Nymphs** generally have the cephalothoraces and legs fairly resembling those of the adult, but the abdomines very different, except in *H. nanus*, where it is more similar.

*Table to assist in the identification of the British species of Hermannia.*

|                                                                 |                                                                                                                                                                                                                                                             |                                                             |
|-----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| With a tubular projection on each side of the abdomen . . . . . | ARRECTA.                                                                                                                                                                                                                                                    |                                                             |
|                                                                 | Pseudo-stig-<br>matic or<br>PICEA.                                                                                                                                                                                                                          |                                                             |
|                                                                 | Abdomen<br>globose<br>or oval,<br>creatures<br>large                                                                                                                                                                                                        | Pseudo-stig-<br>matic or<br>NODOSA.                         |
|                                                                 | Notogaster<br>thickly<br>strewn<br>with raised<br>dots or<br>pits                                                                                                                                                                                           | Abdomen<br>long<br>and<br>sack-shaped,<br>creature<br>small |
|                                                                 | Notogaster<br>without any<br>margin<br>marked<br>differently<br>from the<br>central<br>portion                                                                                                                                                              | Abdomen<br>long<br>and<br>sack-shaped,<br>creature<br>small |
| Without tubular projections of the abdomen . . . . .            | NANUS.                                                                                                                                                                                                                                                      |                                                             |
|                                                                 | Notogaster very<br>coarsely and irregu-<br>larly reticulated . . .                                                                                                                                                                                          | RETICULATA.                                                 |
|                                                                 | Notogaster with a broad lateral margin differently<br>marked from the median portion; the latter finely<br>punctured, and bearing two large longitudinal ridges,<br>with a spoon-shaped depression between them, close<br>to the posterior margin . . . . . | BISTRATA.                                                   |

HERMANNIA ARRECTA,\* Nic., Pl. XLIII, figs. 8—15 ;  
Pl. E, fig. 1 ; Pl. F, fig. 15.

*Hermannia arrecta*, Nic. P. 470.

Average length about ·72 mm.

Average breadth about ·49 mm.

Average length of legs (first pair) about ·36 mm.

Average length of legs (second pair) about ·30 mm.

Average length of legs (third pair) about ·32 mm.

Average length of legs (fourth pair) about ·40 mm.

This species is readily distinguished from all other British species which I am acquainted with by the lateral projections of the abdomen.

**Colour** dull red-brown ; the adult often carries a very thin nymphal cast skin, and then it appears whitish.

**Texture** dull and rough.

**Cephalothorax** considerably narrower than the abdomen ; covered with scattered dots thickly but irregularly placed : it is divided more or less into two parts by a transverse depression not very far from the tip of the rostrum. There is just an indication of a rough longitudinal ridge at the very edge of the cephalothorax. Rostrum very blunt. Rostral hairs rather long, curved, and far apart. Pseudo-stigmata large, projecting, cup-shaped. Pseudo-stigmatic organs long, slightly and gradually thickened at the distal end, the absolute termination being pointed, or almost so ; the peduncles of the organs have a strong turn or shoulder a little before they enter the pseudo-stigmata. Interlamellar hairs very long and setiform ; there is also a pair of similar hairs, not quite so large, on the dorso-vertex, representing the lamellar hairs ; these two pairs of hairs do not show sufficiently plainly in the plate. There are not any tectopedia. Apodemata very strong and joined to the sternum.

**Legs** of moderate length, fourth pair passing the

\* *Arrectus*, erect, lifted up, steep.

hind margin by about half the length of the tarsi; the proximal ends of the tibiæ are considerably narrowed, giving the leg an effect of increasing in thickness both forward and backward from this point (see figs. 13, 14).

**Abdomen** a shortish oval, nearly elliptical. The posterior end the broader; the antero-lateral angles are very slightly thickened and produced, giving the effect of the progaster being a little truncated; it is very much arched. *The whole dorsal surface is covered with thickly scattered raised dots*, which in prepared specimens seem to be on the surface layer of the cuticle only, and to stand above depressions in the reticulation of the deeper layers. These dots average about 100 to the millimètre, and when a piece of the cuticle is examined with a high power it will be seen that the ridges of the deeper reticulation between the dots are pierced by a single series of extremely fine punctures. *On each side of the abdomen*, at the extreme edge, and a little behind the middle, *is a conspicuous chitinous projection* which is thickest where it joins the abdomen, then gradually narrows slightly until close to the tip, where it suddenly widens a little, like the neck of a wine-bottle. This projection is tubular, and communicates internally with a membranous sack, the expulsive vesicle (Pl. F, fig. 15). There are two longitudinal rows of strong setiform, almost rod-like, hairs on the notogaster, and a border of similar hairs nearer the margin, and one or two extra pairs at the posterior end. The arrangement of the notogastral hairs is such that they may be said to be placed in transverse rows, as Nicolet says, if this mode of description be preferred. The whole ventral surface is coarsely dotted. The dorsal plate is considerably sufflexed on to the ventral side. The genital and anal plates are large, nearly close together; the genital almost round, the anal oblong, larger and slightly wider than the genital.

*Nymph.*

**Colour** of the whole creature, except the legs and the tip of the rostrum, is very light rosy purple, so light as to be almost white; it is sometimes slightly shaded at the edges with blue-grey. The legs and tip of the rostrum are rosy brown. The hairs are white.

**Cephalothorax** broadly conical; rostrum truncated; rostral hairs short and thick; pseudo-stigmata nearer than usual to the median line; pseudo-stigmatic organs long, slightly clavate, and standing forward and outward. Interlamellar hairs long, straight, and setiform; there is also a short similar hair outside each pseudo-stigma; a pair of similar hairs, not so large as the interlamellar hairs, is placed on the dorso-vertex, representing the lamellar hairs as in the adult.

**Legs** of nearly uniformly diminishing thickness throughout; the two front pairs are the shorter and are of nearly equal lengths; the coxae are sometimes lighter in colour than the other joints.

**Abdomen** shield-shaped, about half as long again as its greatest width. The cuticle is raised along the progaster, so as to form a roll or fold. The whole notogaster is thickly studded with small roughnesses which look like papillæ when seen projecting at the lateral edges of the abdomen, but appear to the eye more like small areolations when seen from above. There are four rows of strong curved hairs on the notogaster, two longer straight hairs near the hind margin, two smaller pairs nearer the median line, and a single pair of straight stout hairs still nearer to the point of the abdomen. There is a strong curved hair by the antero-lateral angle on each side, and another similar just below the insertion of the third pair of legs. The abdomen has sometimes a slight projecting point posteriorly.

**Distribution.**—The larva and nymph are found in burrows in dead wood; the adult in similar places, and in moss growing on the wood.

I have found the species generally distributed and not uncommon.

The species was originally found in France, and has not to my knowledge been recorded elsewhere, except by myself.

Nicolet figured and described a closely allied species, which he called *H. granulata*, which was distinguished from *H. arrecta* chiefly by the possession of a square plate or shield on the vertex; this species has been recorded in Italy by Berlese and in Germany by Haller. I have not seen such a plate on any English specimens, but the two, almost obsolete, rough, longitudinal ridges on the cephalothorax above mentioned, seem a little like a relic of it.

*HERMANNIA PICEA*,\* Koch. Pl. XLI, figs. 1—9; Pl. F, fig. 16.

*Type species.*

*Nothrus piceus*, Koch. Heft 29, pl. ii.

— *convexus* — Heft 29, pl. i.

*Hermannia crassipes*, Nic. P. 469.

— — — Haller. P. 306.

*Nothrus piceus*, Berlese. "Acari, &c. Ital." fasc. xxxiii.

Average length about .82 mm.

Average breadth about .50 mm.

Average length of legs (first and third pairs) about .38 mm.

Average length of legs (second pair) about .35 mm.

Average length of legs (fourth pair) about .40 mm.

I cannot say why Nicolet altered the name of this species from Koch's name of "piceus," with which he identifies it, to "crassipes." Of course Nicolet's name cannot stand. I have followed Nicolet and Haller's synonymy in adopting *picea* in preference to *convexus*.

\* *Piceus*, black as pitch (*Caligo picea*, Virg.).

as the name of the species, but although Koch's *convexus* and his *piceus* were probably the same creature, the latter being small specimens, yet I think *convexus* is the more typical form and would have been the better name to adopt, but the species is now known as "*picea*" (or "*piceus*"), and therefore I retain it. Nicolet's *crassipes* certainly possesses some of the characters of each of Koch's species.

This is a large, clumsy-looking species, with the abdomen very much arched and the whole creature very thick (from the dorsal to the ventral surface).

**Colour** black.

**Texture** rough and dull, coarsely dotted.

**Cephalothorax** broad and heavy, not much less wide than the abdomen; the frons, which is small, is distinctly divided from the dorso-vertex by a transverse sulcation (the provertex not showing), and there is another strong transverse sulcation on the dorso-vertex, a little in front of the pseudo-stigmata. Thus the cephalothorax is divided into three portions, each of which is arched and rounded. Rostrum broad and deep; the genæ form very slight projections on the epistome. Rostral hairs rather fine, set high up and rather near together. No trace of lamellæ, but the lamellar hairs persist, and are near together, thick, and slightly spatulate. The maxillæ are very strong, tridentate, with the teeth deeply cut (fig. 4 is perhaps hardly strong enough in the dentition). Pseudo-stigmata lateral, placed far forward, only slightly projecting, not large. *Pseudo-stigmatic organs long*, apparently filiform, but when seen from behind or in front with a high power slightly clavate; they take a slight turn or form a shoulder, where they enter the pseudo-stigmata (fig. 5). Interlamellar hairs thick and spatulate, slightly curved; much shorter than the pseudo-stigmatic organs; tectopedia almost obsolete. Apodemata very strong, and joined to the sternum; those in front of the fourth legs are apparently double when seen by a high power, and between the two

halves are a series of interlocking chitinous tabs or teeth ; this can only be properly seen in dissections looking from the inner surface.

**Legs** rough, very thick and heavy, particularly the two front pairs. The two hind pairs are set on projections of the ventral and lateral surfaces of the body. The joints diminish in thickness from the femur onward, the femora of the two front pairs being very broad. The genua are longer than usual, the tibiæ scarcely, if at all, longer than the genua. The tarsi rather long, with a slight elevation about the centre carrying a secondary tactile hair ; in front of this point the tarsus is concave above (figs. 7, 8). Claws very strong. Tactile hairs on the first pair of legs moderately long ; on the other pairs short. There is a whorl of spatulate hairs on each of the three central joints of the first pair of legs, and on the femora of the other legs, and a similar hair on the outside of each genual and tibia of the three hinder pairs, and on each coxa of the two hinder pairs of legs, and a strong, curved, similar hair near the proximal end of each femur of the first two pairs. These various hairs appear only slightly spatulate when seen from above, but in dissections under a high power it is surprising to see how broad some of them are (fig. 9).

**Abdomen** sharply divided from the cephalothorax and elevated above it ; it is *a short ellipse*, but some specimens are rather elongated posteriorly. It is *very much arched*, and is covered with large, irregularly-scattered, raised dots, which average about ninety to the millimètre, the spaces between being usually wider than the dots ; these dots appear to be on the epistracum only, the endostrakum being much more finely granulated. There are six longitudinal rows of thick, spatulate, yellowish-white hairs on the notogaster. Ventral surface not so rough as the dorsal. Genital and anal plates near together, occupying the whole length of the ventral plate, about equal width, the genital almost square, slightly widest anteriorly ; the

anal long, somewhat narrower posteriorly, and with three pairs of hairs at the sides.

*Nymph.*

**Colour** of cephalothorax and legs dull ochre-brown, abdomen a trifle lighter and yellower, but there is considerable variation in different specimens.

**Texture** dull ; cephalothorax and legs granular.

**Cephalothorax** broad and large ; the hinder portion has a longitudinal sulcation with a mammilliform elevation on each side. Rostrum broad ; rostral hairs short and thick ; pseudo-stigmata, pseudo-stigmatic organs, and interlamellar hairs as in the adult.

**Legs** very similar to those of the adult ; in the fully-grown nymph they are slightly shorter in proportion.

**Abdomen** sack-shaped, plainly divided from the cephalothorax, but not usually higher in level ; pro-gaster straight or slightly concave ; hind margin rounded. Notogaster not much arched in young specimens, but considerably so in fully-grown nymphs ; it is entirely covered with irregular wavy wrinkles, which run transversely on the median part of the anterior portion of the notogaster, and on the whole of its central portion, and bend forward on the posterior portion, but run longitudinally and are very undulating on the lateral part of the anterior of the abdomen ; these lateral wrinkles are prolonged a little on to the side of the cephalothorax. There are six longitudinal rows of spatulate hairs on the notogaster as in the adult, but they are not quite so large.

**Distribution.**—This species is found chiefly in moss on old wood, and is consequently most common in wooded districts, but it is common and generally distributed ; it has been recorded in France, Germany, and Italy.

HERMANNIA NODOSA,\* sp. nov. Pl. XLI, figs. 10, 11.

Average length about .87 mm.

Average breadth about .50 mm.

Average length of legs (first pair) about .47 mm.

Average length of legs (second and third pairs) about .40 mm.

Average length of legs (fourth pair) about .53 mm.

This species is very like *H. picea*, but is longer in shape and longer in the legs, and has short pseudo-stigmatic organs instead of long; it is not such a heavy, clumsy-looking creature as *H. picea*, and there are some other differences.

**Colour** varies from moderately dark to very dark brown, sometimes almost black.

**Texture** rough and dull, coarsely dotted, dots sometimes coalescing and forming lines.

**Cephalothorax** large and heavy; rather longer in shape than that of *H. picea*. The frons, which is small, is distinctly divided from the dorso-vertex by a transverse sulcation (the provertex not showing), the hinder part of the dorso-vertex has a median longitudinal sulcation with a large mammilliform elevation on each side, occupying the whole width of the cephalothorax. Rostrum deep and moderately broad, rounded. Rostral hairs set high up and rather near together. No trace of lamellæ, but the lamellar hairs persist, and are near together, thick, and slightly spatulate. Pseudo-stigmata at the antero-lateral edges of the mammillary projections (they are a trifle too near together in the plate); only slightly projecting; not large. *Pseudo-stigmatic organs short*, gradually clavate, blunt-ended, and roughened near the end with small points or hairs. Interlamellar hairs thick and spatulate, slightly curved, as long as, or longer than, the

\* *Nodosus*, covered with knots or knobs.

pseudo-stigmatic organs. Tectopedia almost obsolete. Apodemata strong and joined to the sternum; those in front of the fourth legs show a trace of the double structure united by tabs described in *H. picea*.

**Legs** rough, rather thick and heavy, particularly the two front pairs. The two hind pairs are set on projections of the ventral and lateral surfaces of the body, which, however, are not so large as the same parts in *H. picea*, and the legs are longer than in that species. The joints diminish in thickness from the femur onward. The genuals are longer than usual. The tibiæ of the two front pairs of legs scarcely, if at all, longer than the genuals, those of the two hinder pairs about half as long again. Tarsi long, the two front pairs with a very slight elevation about one quarter the distance from the anterior ends, carrying a secondary tactile-hair. Claws very strong. Tactile hairs on the first pair of legs moderately long, on the other pairs very short or obsolete. There is a whorl of spatulate hairs on each of the three central joints of each leg, the inner hairs of the whorl being absent on the third and fourth legs, a similar hair on each coxa of the third pair, and a strong, curved, similar hair near the proximal end of each femur of the first two pairs. These various hairs are very spatulate when seen from the side with a high power.

**Abdomen** sharply divided from the cephalothorax and elevated above it; it is elliptical, *longer in form than that of H. picea*, or perhaps I should say than the ordinary specimens of that species; it is much arched, and is covered with irregularly-scattered raised dots, the distance between which and their whole arrangement varies so much that it is not possible to give any estimate of distance between them; they are generally probably a trifle smaller than those of *H. picea*, and are often simply scattered in the same manner. A specimen of this nature was selected for the plate in order that it might not be supposed that it could be distinguished from *H. picea* by the arrangement of these

dots; but the dots quite as often are closely approximated, or touching, in one direction but not in the other, and then they form lines, which may be straight, or of twisted, zigzag, or irregular forms, and may be confined to one part of the notogaster, *e.g.* the median portion (the dots being detached on the lateral) or the hinder portion, &c.; or the arrangement of the lines may be different in different parts, they may even form a hexagonal reticulation; but in all instances that I have seen the lines when examined with a high power show their origin from coalesced dots. There are six longitudinal rows of thick, spatulate, yellowish-white hairs on the notogaster. Ventral surface not so rough as the dorsal but somewhat similar in markings. Genital and anal plates near together, occupying the whole length of the ventral plate, of about equal width; the genital almost square, slightly widest anteriorly; the anal long, somewhat narrowed posteriorly, with three pairs of hairs at the sides.

### *Nymph.*

I have not had an opportunity of breeding this species and cannot say with certainty what it is; but Mr. Bostock is of opinion that a nymph apparently belonging to the genus *Hermannia*, which he found in company with the adult in the singular locality where his specimens were obtained, is that of *H. nodosa*. This is probable, and is rendered more so by the fact that I have a specimen of a similar nymph found in a locality where I also found the adult of this species, but the difference of which from the nymph of *H. reticulata* I did not observe at the time of capture. This nymph is extremely like that of *H. reticulata*, but may be distinguished from the ordinary form of it by the abdomen being divided into three parts by a light, somewhat depressed linear marking, the shape of an inverted Y, the stalk of the letter proceeding from the centre of

the progaster, and running backward about half the length of the abdomen, and the arms running outward to the lateral margin. I cannot, however, say for certain that this nymph is not a variety of that of *H. reticulata*.

**Distribution.**—This species, like *H. bistrigata*, appears to be amphibious. I found it at the Land's End, Cornwall, and my cousin, Mr. M. J. Michael, found it in Gower, South Wales, both of us in moss or lichen on land. Mr. Bostock found it in Puffin Island, North Wales, on fresh-water algae, where the water was trickling over the rocks in company with *Scutovortex corrugatus*.

Mr. Bostock and I also found a creature in considerable numbers on the lichen growing in a sand-stone cavern near Stone, in Staffordshire, which seems to agree with this species in all respects except that the abdomen is rather longer and is more oblong than that of other specimens of *H. nodosa*, and the legs seem shorter in proportion; this may possibly turn out to be a distinct species, but at present, not being acquainted with their life-histories, I think it best to treat it as a variety. I am not aware of the species being hitherto recorded.

### HERMANNIA NANUS\* (*Nic.*). Pl. XLIII, figs. 1—7.

*Nothrus nanus*, Nic. P. 458, pl. vii, fig. 5.

*Hermannia nana*, Berlese. Acari, &c., Ital. Notes, fasc. iii.

Average length about ·51 mm.

Average breadth about ·26 mm.

Average length of legs (first and third pairs) about ·23 mm.

Average length of legs (second pair) about ·20 mm.

Average length of legs (fourth pair) about ·27 mm.

\* *Nanus*, a dwarf. As this is a noun it would appear to be correct not to make the gender agree with that of the genus, although there is some authority for the use of the word as an adjective.

This species is easily recognised among the British members of the genus by its small size and long shape.

**Colour** dark brown, usually with a very slight reddish tinge.

**Texture** rough and quite dull. The greater part of the body deeply and coarsely pitted.

**Shape** a very long pyriform and very thick through (vertically); it has the appearance of being much longer in proportion to its width than the measurements show; this is the case in many species, and probably arises from the measurement of width being taken between the extreme widest points of the curved abdomen, whereas the eye of the observer recognises the general width but appreciates the full length.

**Cephalothorax** conical, deeply excavated for the insertion of the first pair of legs, and to a lesser degree for those of the second pair; between these pairs of legs are two, and between the second and third pairs one, small chitinous projection on each side, which are, in fact, small tectopedia. Rostrum round-pointed. Rostral hairs short and rather thick. Mandibles and maxillæ only slightly dentate. Pseudo-stigmata rather dorsal and placed far forward on the front-outer sides of two large, paired, chitinous mammillæ, which extend back to the progaster, and have a depression between them, in which are placed two short ridges approaching each other and then prolonged forward; these probably represent the lamellæ. A thickened ridge runs along the upper lateral edge of the cephalothorax on each side as far forward as the front of the pseudo-stigmata; these ridges are joined by a transverse ridge at the back of the cephalothorax close to the progaster, between which and the ridge there is a narrow trench. The pseudo-stigmata are rather small, projecting truncated cones. Pseudo-stigmatic organs rather long and rod-like, or very slightly thickened at the ends, which are sometimes rough. Interlamellar hairs short, thick, slightly recurved. Apodemata joined to the sternum.

**Legs** rather short, the fourth pair scarcely reaching

the hind margin; flattened, and gradually diminished in width toward the distal ends. Coxæ of the two front pairs turned almost at right angles to the femora. Tarsi blunt-ended. There are thick, rod-like, curved hairs arranged in whorls on the three central joints of most legs, two similar largish hairs on the outside of each coxa of the third pair, and two extra hairs of the like nature on the outside of each femur of the second pair of legs. There are the usual hairs on the tarsi, which also bear some short thick hairs on the actual end, which often appear like side-claws, and there are some short laurel-leaf-shaped spines underneath this joint, and one or two above. A high power is required to see their form.

**Abdomen** long, almost sac-shaped, having the appearance at first of being nearly parallel-sided; but this is soon seen not to be so, although this shape is approached much more closely than is usual in the family. Sides almost vertical; back very much arched and raised. Progaster nearly straight, with rounded corners. Hind margin rounded. Notogaster and under-surface deeply and coarsely pitted, the spaces between the pits usually rather wider than the diameter of the pits; the sizes of both, however, vary considerably, the pits average about 75 or .80 to the millimètre. The genital plates are almost round, and in the usual place. The anal plates are very large, long-shaped, but surrounded by an almost circular ring, and they extend on to the actual hind margin. The notogaster bears eight rather irregular rows of thick, white, rod-like hairs, directed backward; and there are a few round the hind margin.

### *Nymph.*

This is so similar to the imago that it is not necessary to describe it separately; it could scarcely be mistaken; it is, however, rather less long in shape; the

cephalothorax and legs are reddish-brown, the abdomen dirty-white, and the latter has a few wrinkles near the progaster.

**Distribution.**—I have found this species most at Epping Forest; it is fairly generally distributed, but I have not ever found it common. It has been recorded in France and Italy.

**HERMANNIA RETICULATA, Thorell.** Pl. XLII, figs. 1—7.

*Hermannia reticulata,\** Thorell. Oefversigt af K. Svenska Vetenskaps-Akad. För-hand., 1871, p. 696.

Average length about .85 mm.

Average breadth about .50 mm.

Average length of legs (first pair) about .40 mm.

Average length of legs (second pair) about .36 mm.

Average length of legs (third pair) about .33 mm.

Average length of legs (fourth pair) about .50 mm.

I believe the English species to be that described by Thorell, and above referred to, judging from his description, but that eminent arachnologist described it from a single specimen sent from Bell's Sound, Spitz-bergen, probably somewhat altered from what it would have been in a living condition; consequently I was disappointed in the hope that Thorell might tell me with certainty whether his species was mine or not.

The English species may be easily distinguished from all others of the genus by the reticulation of the notogaster.

**Colour** black or dark brown, lighter in specimens lately emerged.

**Texture** dull, between the reticulations it is extremely finely granular, but rather a high amplification and careful management is required to see this.

**Cephalothorax** rather large, finely and regularly re-

\* *Reticulatus*. made like a net.

ticulated almost all over, the hinder portion much the broader and considerably arched, sometimes with a longitudinal median cut. The hinder edge of the frons is very distinctly marked, the division between the vertex and provertex is less distinct, but still clear. Rostrum with a tendency to be trifid. Rostral hairs short and sharply curved. The palpi do not show from the dorsal aspect, but when dissected they are found to have the second joint much incrassated. Maxillæ deeply toothed with one large square, and three smaller pointed teeth. There are not any lamellæ, but the lamellar hairs persist, and are short, spatulate, and placed far forward. Pseudo-stigmata placed rather far forward, small, and not projecting. *Pseudo-stigmatic organs* very short, with short peduncles, and short, pyriform heads (the engraver has made these organs a trifle too long in fig. 1). Interlamellar hairs short, spatulate, often somewhat recurved. Tectopedia obsolete; apodemata joined to the sternum.

**Legs** of moderate length, thick, gradually diminishing in thickness from the femur onward; regularly reticulated all over, including even the tarsi. Two front pairs of femora with short, comparatively thin peduncles, turned nearly at right angles to the rest of the joint. Genuals as long as the tibiæ; tarsi nearly as long as the two last-named joints together; slightly truncated at the distal end. There are two or three thick spatulate hairs arranged in a whorl on each of the three central joints of each leg, and a similar hair near the proximal end of each of the femora of the first two pairs, and one on each coxa of the third pair. Tactile hairs rather small; tarsi with fine hairs as usual.

**Abdomen** elliptical, rather long; the progaster rounded, and projecting over the cephalothorax; the posterior end produced into a slight lobe, varying in distinctness in different specimens, and bearing two spatulate hairs. The whole notogaster is divided by ridges into large, very irregular reticulations, which

have not any fixed shape, size, or plan, but they are generally more or less angular. These ridges are of about the same thickness in all reticulations, but the interspaces vary extremely; they are, however, seldom less than four or five times as wide as the ridge; they often have one or more detached, raised, chitinous dots in them. The ridges, even under a moderate power, show a strongly undulated outline on each side, giving them a moniliform appearance, as though they were composed of coalesced dots, which probably is really the case, considering what occurs in *H. nodosa*. This appearance is stronger in some specimens than in that from which fig. 7 was drawn. There are four longitudinal rows of spatulate hairs on the notogaster, two pairs on the hind margin, besides the central pair before named, and a few on the progaster and edge. The ventral surface is finely reticulated. The genital and anal plates occupy almost the whole length of the ventral plates; they are of about equal width, the former almost square, the latter a long oblong, slightly narrowed posteriorly.

### *Nymph.*

**Colour** of rostrum and legs red-brown, of the rest of the body yellow-ochre or yellow-brown.

**Texture** of rostrum and legs chitinous and rough; of the rest of the body leathery and rough.

**Cephalothorax** very similar to that of the adult in all respects except colour and texture, and that there are much more signs of lamellæ, which, however, have been rendered rather too strongly by the engraver in fig. 2, and that the rostrum is more truncated, the genæ more plainly divided from the frons, and the pseudo-stigmatic organs, although about the same length, are less enlarged at the ends and show less division into peduncle and head than in the adult.

**Legs** similar to those of the adult, but the two front pairs of femora have not got the peduncles so thin.

**Abdomen** oblong, generally sharply constricted a short distance from the posterior margin, the postero-lateral angles of the portion behind the constriction are formed by two large raised lobes, which cause the corners of the abdomen to project, and each bears a spatulate hair on the top of the lobe ; these two lobes are usually, but not invariably, joined by an elevated roll concave posteriorly. Between these two lobes the hind margin of the actual dorsal surface is nearly straight, but is broken by two lobes lower in level and also bearing spatulate hairs ; often there is not any sharp distinction between these and the dorsal surface. The progaster is straight or slightly concave ; the notogaster is a flat surface with raised lobes and rolls upon it ; these are, firstly, a large raised roll forming the lateral edges, and often united by a similar roll forming the progaster, so that the whole of the lateral and anterior margin is formed by one continuous roll ; the lateral part of this roll is usually, but not invariably, cut into a series of lumps or lobes, as in fig. 2, and there are three pairs of lumps or lobes, forming two longitudinal rows nearer the median line ; the two lobes of a pair often almost touch, sometimes they coalesce, and sometimes they may coalesce with those behind them ; this produces considerable variety in the appearance of different specimens, or possibly of the same specimen at different ages. There are two longitudinal lines of spatulate hairs on the notogaster, and a line of similar hairs near each lateral margin ; when the lobes, or lumps, are distinct there is usually one of these hairs on each lobe.

**Distribution.**—I have found the species at the Land's End, Cornwall, and in Staffordshire, and have received it from Wales and the Isle of Man ; it seems rather more frequent in places within a moderate distance of the sea ; I find it in lichen and moss. I am not aware of its having been taken abroad, except Thorell's specimen above referred to.

HERMANNIA BISTRIATA\* (*Nic.*). Pl. XLII, figs. 8—14.

*Nothrus bistriatus*, Nic. P. 457.

*Hermannia bistriata*, Michael. Journ. Roy. Microsc. Soc., ser. i,  
vol. iii, p. 11.

*Nothrus palliatus*, Koch. Heft 29, fig. 21. Nymph.

— *cirrosus*, Can. e Fan., p. 24. Nymph.

Average length about .85 mm.

Average breadth about .40 mm.

Average length of legs (first pair) about .33 mm.

Average length of legs (second pair) about .26 mm.

Average length of legs (third pair) about .28 mm.

Average length of legs (fourth pair) about .42 mm.

This is a handsome and well-marked species; it is not a typical *Hermannia*, but is one of those forms which approaches to the genus *Nothrus*, indeed, its resemblance to *N. Targionii* is striking. It is particularly interesting from the fact of its nymph being practically amphibious. It is probably not the *Nothrus bistriatus* of Koch, although Nicolet supposed that it was; Nicolet also fell into another error with regard to it; he states it to be an immature form of *N. palustris*, which is certainly incorrect, it is mature and quite a distinct species; although Nicolet says that he saw *N. palustris* emerge from it, he has made a mistake of some sort.

**Colour** dark chestnut-brown or black; legs lighter brown.

**Texture** of cephalothorax rough, and deeply pitted; of abdomen almost smooth (between the ridges) but not polished. Legs rough.

**Form** an elongated pyriform, somewhat truncated posteriorly.

**Cephalothorax** rather large and wide; a good deal arched. Rostrum rounded with a small median blunt point. Behind the rostrum the cephalothorax widens, with a small, rounded shoulder on each side; then its

\* *Bis*, twice; *striatus*, furrowed, grooved.

lateral edges run almost straight backward for about one-third of its length, and then it again expands with a large rounded projection on each side; the pseudo-stigmata are placed about the centres of these rounded elevations. There are two longitudinal, irregular ridges, one a little on each side of the median line, and there is a slight, transverse, irregular ridge across the cephalothorax behind the pseudo-stigmata; between this ridge and the progaster there is a deep sulcation or trench. The whole cephalothorax, except the rostrum, is thickly covered with irregular rounded pits, which leave ridges between them as wide as the diameter of the pits. These pits vary greatly, but average about 120 to the millimètre. The rostral hairs (omitted in drawing) are small and curved, the lamellar hairs spatulate, large, and slightly dentated at the inner distal edges. Pseudo-stigmatic organs moderately long, and filiform or rod-like; interlamellar hairs short, thick, white, and incurved. Apodemata joined to the sternum.

**Legs** short, thick, conical; fourth pair scarcely passing the hind margin. The three central joints of the first and second pairs of legs each have a whorl of short, thick, sharply-curved white hairs, and there are two or three extra similar hairs at the outer edge of each second, and the inner edge of each first femur. There are three similar hairs on the outside of each femur and two on each genual and tibia of the third pair, also similar hairs on the outside of each joint except the tarsus of the fourth pair. The hairs on the upper edge of the tarsi are similar in character to those on other joints; the remaining hairs on the tarsi are fine. The claws are short, thick, and strongly curved.

**Abdomen** considerably longer than broad; truncated anteriorly, slightly truncated posteriorly, but with a rather rounded outline there. The progaster is a rough transverse ridge extending right across the creature. From this transverse ridge six longitudinal, irregular,

rough ridges extend backward, almost to the hind margin; two of these, thinner than the others, are on the extreme lateral edges of the abdomen; two similar but larger ridges run a little way within the margin; the space between these and the peripheral ridges on each side is almost flat, or very slightly raised, and is crossed by numerous short, irregular ridges, forming a bond of union between the two longitudinal ridges. The notogaster within the last-described longitudinal ridges is considerably elevated along the median line, gradually sloping down, having a shape like an inverted boat (without a keel). The remaining two ridges divide the notogaster into three longitudinal bands of about equal widths, but the central band is narrower anteriorly than posteriorly; and these ridges are shorter than the others, where they cease posteriorly the hinder portion of the abdomen is hollowed out, but the actual hind margin is again raised, so that a basin-like depression is formed. The whole notogaster has sparse, irregular, round punctures; the space between the punctures is usually six or eight times the diameter of the punctures. The hind margin usually has five slight, rounded projections, with a minute knob between each from which springs a thick, curved, white hair; there are six of these hairs, and three similar hairs, but longer and less sharply curved, on each lateral edge of the abdomen, a few smaller on the progaster, and a row close to each of the two central ridges. These last are omitted in the figure.

The genital and anal plates are large and close together, the former nearly square, the latter oblong, narrowed posteriorly. The expulsive vesicles and their pore for discharge, which is dorsal, are well seen under favorable circumstances.

### *Nymph.*

This nymph is the *Nothrus palliatus* of Koch, and Berlese states\* that he has examined the type specimen

\* "Acari, &c. Italiani," 'Notes,' fasc. iii, p. 13.

of Canestrini and Fanzago's *N. cirrosus* and finds it to be the same nymph. I rely on this statement for the synonym.

**Colour** of legs and a plate covering the anterior and central parts of the cephalothorax red-brown, rather dark; of the remainder of the body yellowish-white.

**Texture** of the above-mentioned plate and the legs hard, chitinous, and rough; of the remainder of the body leathery, finely dotted or granular.

**Cephalothorax.**—As before stated, the rostrum and the central part of the greater portion of the cephalothorax are covered by a rough chitinous plate (not well seen in very young specimens) which does not reach the progaster. As far as this plate extends there is not much difference from the adult, but the division of the frons from the posterior part of the cephalothorax is not so distinct. The rostral and lamellar hairs (the latter omitted in the drawing) are like those of the adult. The portion of the cephalothorax behind and at the sides of the plate is very different from that in the adult; it is soft, rather formless, not very clearly divided from the abdomen, and I have not been able to trace any pseudo-stigmatic organs or pseudo-stigmata. This is interesting, the nymph being amphibious, considering that these organs are often absent or rudimentary in aquatic species. What I suppose to be the interlamellar hairs are smaller than in the adult.

**Legs** very similar to those of the adult; the tarsi have three or four, short, strong spikes on their under side, and there is a similar spike under each tibia.

**Abdomen** bag-shaped, rounded posteriorly, and widest near the posterior end; it is apt to fold into slight, irregular transverse wrinkles, which are not sharp nor conspicuous. It is finely dotted all over, and the posterior and lateral margins are bordered with thick curved hairs. There are two longitudinal rows of somewhat similar hairs on the notogaster (omitted in the drawing) and a few small hairs on the progaster.

All these hairs are very caducent. The creature is often seen without any except those on the hind margin.

**Distribution.**—The species is generally distributed and not uncommon. I have found the adult in moss on land, the nymph I have found in the same situation and also on *sphagnum* under water; it seems to thrive equally well in either locality. I have not ever found the adult in water, but one or two which I placed on *sphagnum* under water and kept there for some time did not appear to experience any inconvenience. The species has been recorded in France, Germany, and Italy.

#### GENUS—EREMÆUS,\* Koch.

*Apterogasterinæ* with cephalothorax anchylosed to abdomen; without lamellæ; with the notogaster arched or concave in the centre, the margin being thin, and raised or depressed, and the postero-lateral parts of the dorsal plate of the abdomen greatly turned over on to the ventral surface, and greatly overlapping the ventral plate, which narrows to a point posteriorly. All known species are tridactyle.

I am not sure that it would not be better to eliminate the name of this genus, but the name is so well known for certain species that it would be a pity to lose it unless it be necessary to do so. The position is as follows:

Koch originated the genus. His definition of it is really not sufficient to enable anyone to say what belongs to it; he gives only two species, viz. *E. hepaticus* and *E. oblongus*. I do not see upon what ground Koch separated these two creatures from *Notaspis*, which he calls *Oppia*; neither the difference between his descriptions of the genera nor between

\* Ἡρμαῖος, quiet.

the creatures appears to me to be important enough. Nicolet came later; he took *E. oblongus* as his type and described his genera distinctly enough; to distinguish *Eremæus* from *Notaspis* he relied chiefly on the absence of lamellæ in the former genus and their presence in the latter, and on the claws of *Eremæus* being heterodactyle while those of *Notaspis* are homodactyle; but, firstly, it seems to me that *oblongus* does possess lamellæ, although they are small and ill developed; secondly, that the classification by homodactyle and heterodactyle claws has altogether broken down; and indeed in *Eremæus brevipes*, a species closely allied to Nicolet's *E. cyma*, the claws are as homodactyle as in some of the *Notaspides*. Unfortunately, Nicolet only knew of three species of *Notaspis*, and he was doubtless influenced by regarding the lamellæ as the up-turned edges of a tectum (an imaginary organ which does not exist) instead of what they really are, viz. outfoldings of the cuticle of the dorsum of the cephalothorax; had he been acquainted with the species known now, and had he been uninfluenced by the idea of a tectum, I do not think that he would have separated his *E. oblongus* from *Notaspis*. Nicolet, however, did not stop here; he put into the genus *Eremæus* two new species discovered by him, *E. tibialis* and *E. cyma*; these really are creatures which could not, in any way, be properly included in the genus *Notaspis*, and in my opinion they fairly require a separate genus, and, in spite of some trifling points of agreement, I think they should not be in the same genus as *oblongus*; they are perfectly well known as *Eremæus*. I have therefore transferred *oblongus* to *Notaspis*, where I think it should be, and possibly I ought to have dropped the name of *Eremæus* and given a new name to the present genus; I have not liked, however, to do this as *Eremæus cyma* is so well known. I have therefore retained the name, taking *cyma* as the type; the reader will therefore kindly remember that whatever the present genus, in this book, should be called,

it is founded on *cymba* as a type; and that it properly would include Nicolet's *E. tibialis*, which I have not found in England.

It must also be remembered that very few species are known; possibly therefore some day the generic description may require modification.

The **Rostrum** is rounded and blunt; extremely so in *E. cymba*; the rostral hairs are generally short.

The **Labium** is broad and short; it has a curious semicircular central projection, answering in fact to the ligula (or paraglossæ) of insects. The existence of such an organ as this is common enough among the Oribatidæ, but the form and exact position are unusual; and the organ is generally in two halves, and consequently paired, whereas in this instance it is azygous, as in *Pelops*.

The **Palpi** have the second joint long and thick, the third and fourth short, the fifth long and thin, becoming suddenly thinner about the middle, where there may be a projection or branch (Pl. XLIV, fig. 5).

The **Maxillæ** are long with produced outer angles (fig. 14); they are unusually free from the lip in *E. cymba*, and show apophyses for attachment of muscles very plainly in *E. brevipes*. This does not appear in fig. 14.

The **Mandibles** are short, but stout and powerful, the movable arm of the chela sometimes much curved, bidentate at the tip. The teeth powerful, and those of the fixed arm set within the edge.

The **Pseudo-stigmata** are almost at the edge of the body. The pseudo-stigmatic organs of the British species have very short peduncles and almost globular heads; but this would not apply to Nicolet's *E. tibialis*.

The **Lamellæ** are absent.

The **Tectopedia**.—The second pair are moderately developed, the first absent, the others just indicated.

The **Opisthophragmatic processes** are entirely absent.

The **Apodemata** are short, not joined to the sternum.

The **Legs** in the known species seem to be rather

thin (as compared with *Nothrus*, *Hermannia*, &c.). The femora of the two front pairs have short peduncles; the tibiæ are often the longest joints, and those of the front pair have a chitinous projection in the median line which carries the tactile hair. The tarsi are tridactyle in all known species; the claws large and powerful.

The **Abdomen** is usually oval, widest not very far from the hind margin, and with just an indication of a median posterior point, which may be absent. The central portion of the notogaster is generally more or less arched, but may be concave (*tibialis*); the marginal part curved upward or downward; but the two curves may fade into one another so that no sharp line of demarcation can be drawn. The general effect of the creatures in this genus is of having a rather flat abdomen; the edges of the abdomen are thin. The notogastral plate commences behind the legs to be largely sufflexed on to the ventral surface, and embraces the ventral to an unusual extent, leaving the portion of the ventral plate which is seen lancet-shaped and pointed posteriorly (Pl. XLIV, fig. 3); but the sufflexed parts of the dorsal plate do not meet at the median line of the posterior margin; they leave a small open space there.

The **Genital and Anal Plates** are large, the former square, the latter somewhat oblong.

The **Texture** of the notogaster and ventral plates in all known species is rough and dull, either coarsely reticulated, covered with large raised dots, or otherwise roughened.

The **Cæca** of the ventriculus are very long and large; sausage-shaped.

The **Ovipositor** is long and rather fine.

The **Hairs**, both on the notogaster and most of those on the legs, are usually very short, but thick in proportion, very caducent, and often seen with difficulty. The lamellar and interlamellar hairs are usually of a similar nature.

The nymphs of this genus which I know are very different from the adults of the respective species.

The two English species are chiefly found on the leaves and boughs of trees, especially oaks, in spring.

*Table for identification of British species of Eremæus.*

|                                 |   |   |                  |
|---------------------------------|---|---|------------------|
| Margin of the abdomen turned up | : | : | <i>cymba.</i>    |
| Do. do. down                    | : | : | <i>brevipes.</i> |

**EREMÆUS CYMBA,\* Nic. Pl. XLIV, figs. 1—11.**

*Type species.*

*Eremæus cymba*, Nic. P. 451, pl. x, fig. 3.

— — Can. e Fan., p. 22.

— — Berlese. Acari, &c. Ital., fasc. xxxiii.

Average length about ·70 mm.

Average breadth about ·42 mm.

Average length of first and third pairs of legs about ·35 mm.

Average length of second pair of legs about ·30 mm.

Average length of fourth pair of legs about ·45 mm.

This is a well-marked and handsome species ; its most conspicuous characters are the raised margin of the abdomen and the very blunt rounded rostrum.

**Colour** yellowish-brown, not dark ; it is usually about the tint of light-oak furniture, but varies a good deal.

**Texture** quite dull, rough, and leathery ; without the slightest gloss, but yet it is chitinous, not soft.

**Shape** almost pyriform, very slightly pointed posteriorly.

**Cephalothorax.**—Rostrum extremely blunt and rounded, almost truncated ; rostral hairs very short.

\* Κύμβη, a boat.

A thick, rough, chitinous, transverse ridge separates the frons from the provertex, extending the whole width of the cephalothorax; from each end of this ridge a similar ridge runs longitudinally backward along the side of the cephalothorax. This transverse ridge is prolonged forward a little beyond the juncture with the transverse ridge, thus forming a short projection which stands free. Inside these ridges are two smaller and shorter longitudinal ridges which start from the pseudo-stigmata and approach each other anteriorly; they are probably the homologues of the lamellæ. Mandibles short and wide but powerful; the movable chela very strongly curved and dentate chiefly at the end. Pseudo-stigmata far apart, only slightly projecting, directed outward. Pseudo-stigmatic organs very short, with almost globular heads on extremely short peduncles. Lamellar and interlamellar hairs very short and thick; they look almost like chitinous points and are caducent. The first and second pairs of legs are carried on a broad lateral shelf of the cephalothorax, which is deeply cleft to receive their articulations. Small second and third tectopedia are present on this shelf, in a modified condition. There do not appear to be any opistophragmatic processes. The whole upper and lateral surface of the cephalothorax is rough and coarsely granulated or reticulated, the markings being irregular. The dorso-vertex rises to a small round elevation on each side with a broad irregular sulcation between them; behind these elevations the cephalothorax falls and narrows considerably; but it rises again somewhat, at its actual posterior margin, to join the raised progaster.

**Legs** rather short, of nearly equal thickness throughout. Coxæ of first and second pairs hidden; those of third and fourth pairs large, rounded, and conspicuous. The femora of all legs are large. Those of the two first pairs of legs have very short, slender, curved peduncles for the purposes of articulation. The tibiæ are long, the tarsi rather short and inversely

pyriform. There is a chitinous projection from the tibia of each leg of the first pair which carries the tactile hair. The central unguis is the thickest, but shortest and most sharply curved. The whole texture of the legs, but specially of the coxae and femora, is rough and granular. There are a few short, curved, fine hairs on each of the three central joints of each leg, mostly arranged in one or two whorls; and there are a few very short stumpy hairs or spines on the femora, and some shortish fine hairs on each tarsus.

**Abdomen** oval, slightly truncated anteriorly, and produced to a small point posteriorly; *its margin is sharply raised* all round, the raised border being broad and sloping up from within outward (the outer edge being the higher); it is more raised anteriorly than posteriorly. Within this border the back is slightly arched, but the highest part of the central portion is not higher than the outer edge of the border. The raised border has a small blunt point just behind each pseudo-stigma. The whole notogaster, including the raised border, is *coarsely reticulated* by irregular raised ridges which leave large, shallow, depressed spaces between them. Each of these spaces is divided by smaller similar ridges into lesser divisions, which are not so easy to see as the principal reticulations. The chitin of the notogaster itself is slightly granular. The whole of the markings are extremely irregular and vary greatly in different specimens, indeed probably two examples really similar are not ever found; but the character of the markings is constant. There is sometimes a slight median depression of the notogaster, particularly near the progaster. There are two longitudinal rows of very short, thick, stumpy hairs on the notogaster; they hardly look like hairs, and are very caducent; there is a row of similar hairs a little within the lateral and hind margins. These hairs are not shown in the drawing, indeed they are almost too small, but a few of them are indicated round the hind margin of fig. 3; those in this situation show most

as they project a little. The ventral plate is much smaller than the dorsal, which is reflexed, and embraces the ventral plate, particularly posteriorly. The whole ventral surface is reticulated like the dorsal. The genital and anal plates are very large, and close together; the former almost square, the latter oblong. The apodemata do not reach the sternum. There is a lateral tooth-like projection of the ventral plate between the second and third pairs of legs.

*Nymph.*

**Colour** light, but dull, yellowish-brown or buff, shaded with a dull greenish tinge. Legs and rostrum redder.

**Texture** leathery, without the slightest polish.

**Cephalothorax** not very unlike that of the adult, but still with considerable differences from it. The rostrum is less wide, and much less rounded; it is slightly truncated; the genæ being more distinctly separated from the frons than in the adult. In living specimens a more pointed effect, as in the figure, frequently arises from the position in which the rostrum is held, and the slight protrusion of the points of the mandibles (unfortunately in engraving and printing my lines showing how this effect arises have become obliterated). The remainder of the cephalothorax has really much the same ridges, &c., as in the adult, but the transverse ridge is not so straight, and curves more into and forms a line with the lateral ridges, and the whole is less hard and sharp, and more apt to run into minor wrinkles and granulations, particularly at the side, than the harder cuticle of the imago. The rostral, lamellar, and interlamellar hairs are short and have tiny peduncles, and little, more or less globular heads (as to which see below when those on the abdomen are mentioned). The lamellar and interlamellar hairs are rather larger than those of

the adult. The pseudo-stigmatic organs are much the same as those of the adult.

**Legs** short, the fourth pair not reaching the hind margin in fully-grown specimens. The peduncles of the front femora are not so fine as in the adult, nor the joint itself so broad; the tibiæ, particularly of the first pair, are nearly as wide as the femora, but have not the chitinous apophysis for the tactile hair found on this joint of the first leg of the adult. The three central joints of the legs have a more or less perfect whorl of very short, thick, stumpy hairs, much like those on the body; each third coxa bears one similar hair, and there are a few fine hairs on the tarsi and elsewhere.

**Abdomen** bag-shaped, the progaster either nearly straight or considerably convex in the centre; it is usually exactly the same width as the base of the cephalothorax, so that the two form one line. The abdomen gradually increases in width with a slightly curved outline until about one-third of the distance from the posterior end; at this point the broad, rounded, hind margin may be said to commence. The notogaster is slightly arched, and is covered by large, loose, irregular wrinkles, which probably were not ever alike in two individuals; in some an irregular, more or less inversely pyriform depression is found in the median line near the progaster, as in the drawing; but this is not always present. The wrinkles are apt to be more transverse and parallel near the lateral margins, irregular and vermiciform near the centre of the notogaster, and more longitudinal near the hind margin. There is a row of hairs round the lateral and hind margins and a few on the notogaster; about four pairs of these hairs project beyond the hind margin, and are plainly seen; the others are difficult to see and are very caducent. I did not think that any useful purpose would be served by attempting to depict them. All these hairs, as is the case with those mentioned as being on the cephalothorax, are very short, with tiny peduncles,

and little, more or less globular heads, those on the hind margin being usually the most globular. When seen with an amplification of about 500 diameters these hairs are seen to be composed of a central stalk with a number of small spherical granules grouped round it forming the head, and looking a little like a miniature black-berry. The whole ventral surface is wrinkled.

**Distribution.**—I had considered this an extremely rare species. Other collectors besides myself have found a solitary specimen now and then, at long intervals, but have searched the same places over and over again without securing another; in 1885, however, I went to the New Forest in spring, when the oak trees were just coming into leaf, and by beating the branches at this time, I found, to my surprise, that *E. cymba* in all stages descended in great abundance, and should think I must have seen thousands.

The species has been recorded in France (Bois de Meudon); and something stated to be the same species has been recorded in Italy; I doubt, however, very much whether the Italian specimens are the same species; at all events, if Berlese's drawing can be in any way relied upon, the markings on the notogaster are entirely different from those on Nicolet's beautifully executed drawing, which agree exactly with my specimens, and the position of the genital and anal plates is very different in Berlese's drawing from what it is in my specimens. Unfortunately his figure of the under-side does not give the demarcation between the ventral and dorsal plates, nor indeed any other detail.

EREMÆUS BREVIPES, sp. nov. Pl. XLIV, figs. 12—19.

Average length about .29 mm.

Average breadth about .16 mm.

Average length of legs (first pair) about .12 mm.

Average length of legs (second pair) about .11 mm.

Average length of legs (third pair) about .10 mm.

Average length of legs (fourth pair) about .13 mm.

A very small species, having a considerable resemblance to *E. cymba*, but which could not be mistaken for it, even on a cursory examination, by anyone acquainted with the last-named species.

**Colour** light oak-brown, getting much darker towards the posterior margin of the abdomen.

**Texture** rough and dull.

**Shape** short-pyriform.

**Cephalothorax** rough, with irregular raised dots or rugosites, but *without any regular markings*; it is sharply divided from the abdomen by a deep narrow sulcation. Rostrum rounded at the tip, but much narrower in proportion than that of *E. cymba*. Rostral hairs short and curved, springing from small projections. No trace of lamellæ or translamella. Pseudo-stigmata rather large, at the extreme edge of the body. Pseudo-stigmatic organs with very short peduncles, and large, almost globular heads. Interlamellar and lamellar hairs very small, almost rudimentary, but thick in proportion to their length. There are two small projections on each side carrying the legs.

**Legs** short, fourth pair scarcely reaching the hind margin; roughish; femora of the two front pairs with short peduncles. Tarsi large; the proximal parts approaching a globular, or very short pyriform, shape, but ending in a straight rod-like portion carrying the claws, which are large and tridactyle, almost but not quite homodactyle. Most of the joints have two or three short, sharply-curved hairs; the tarsi are densely clothed with fine hairs, and the tactile hairs are well-developed.

**Abdomen** widest near the posterior margin, having a truncated appearance; it slopes downward from the anterior to the posterior margin; the latter seems truncated perpendicularly as well as horizontally, so that the hind edge is thick. The *median line is much*

*raised* except near the hind margin. The raised portion is arched but does not sink gradually to the edge of the abdomen except anteriorly, being surrounded on the other sides by a broad, more horizontal, and much more gently curved portion, which, however, *does not rise towards the lateral margin* as that of *E. cymba* does. The progaster is narrow and convex; the hind margin has a very small median point. The notogaster is reticulated; the reticulations rather regular but not hexagonal, about 110 to the millimètre; the depressions are very shallow and about five times as wide as the intervening ridges, so that the abdomen looks rather as if fine net were stretched over it; but the reticulations most usually have a straight side, not a point directed forward. There are a few very short sharply curved hairs round the hind margin, and four rows of minute hairs on the notogaster, very caducent and not easily seen. The sides of the dorsal plates are much turned over on to the ventral surface posteriorly, but with a piece scooped out in the median line below; the hinder part of the ventral plate small and almost triangular, with straight sides and the point directed backward. Genital and anal plates nearly square, the latter rather more oblong, the former placed far forward, the latter near the posterior end.

### *Nymph.*

**Colour** light yellow-brown, with a somewhat darker and redder shade over the legs and the hind portion of the abdomen.

**Texture** dull, leathery.

**Shape** pyriform and tolerably regular.

**Cephalothorax.**—Rostrum conical, truncated, with an obtuse central point; the ends of the palpi show slightly beyond the anterior margin; it is divided from the rest of the cephalothorax by a sharp indentation. The remaining portion of the cephalothorax is rounded,

and divided by longitudinal ridges or folds. Pseudostigmatic organs very like those of the adult but much smaller in proportion. Interlamellar hairs similar to those of the adult.

**Legs** short and thick ; hind pair not reaching the posterior margin ; all the tarsi short and rather globose at the proximal ends. The two front pairs have the tactile hair, but not very large. The tarsi have the usual fine hairs ; the other joints are almost hairless.

**Abdomen** truncated anteriorly, and the same width as the cephalothorax where they meet, but the abdomen increases in width for more than half its length. Hind margin rounded, with a scarcely observable central point. The notogaster bears the following folds or rolls, viz. one round the actual anterior margin, widening at the ends and returning along the anterior portion of the lateral margin ; three transverse folds about the middle ; three folds forming a figure like a broken capital A, anterior to the transverse folds ; and a broad central longitudinal fold posterior to the transverse folds. These markings probably vary in different specimens. The whole surface is slightly rough. There are three short curved clavate hairs on each side of the posterior margin.

**Distribution.**—The nymph and perfect form are sometimes found in considerable numbers on the foliage of trees, particularly oaks, about May. I have found it at Dorking in Surrey, and at Epping Forest and the New Forest, but especially in the last-named place ; when found at all it appears to be usually in abundance. I am not aware of its having been recorded hitherto.

## GENUS—NOTHRUS,\* Koch.

Equals part of *Nothrus*, Koch.

Equals *Liodes*, and some other genus or genera, but it is not known which, Heyden.

Equals *Nothrus*, Nicolet, Canestrini, &c.

Equals *Nothrus* and *Liodes*, Berlese.

*Apterogasterinae* with cephalothorax ankylosed to abdomen; without lamellæ. Abdomen square, oblong, rhomboid, or shield-shaped. Notogaster flat or hollow, or with a raised margin; cuticle of adult usually imperfectly chitinised. Abdomen not segmented.

This genus was instituted by Koch, but he does not define it clearly, and the creatures which he includes in it are a very ill-assorted group; it is scarcely possible to have much confidence as to what Koch's idea really was; the main strength of his genus, however, is formed of what is now considered as the genus *Nothrus*. Nicolet defined the genus much more clearly, although he included one or two species which it is necessary to exclude (as *Hermannia nanus*); his reliance on the claws as a basis of classification has broken down, but in most other respects his views may be considered correct; he took for his type *N. spiniger*, and in my opinion he could not have selected a better. I have retained this species as my type. Berlese has lately taken *N. horridus* as a type; it would have been a good type, but not better than *N. spiniger*, and it is open to the objection that acarologists are not agreed as to what is the true *N. horridus*; indeed, in my opinion, Berlese's *horridus* is not the original species (of Hermann).

Such species as *N. spiniger* and *N. horridus* are forms quite distinct from every other genus, and there are many other species quite of the type of these two; but these typical forms are joined by several inter-

\* Νωθρός, sluggish.

mediate species to *Hermannia* on the one side and to *Hypochthonius* on the other; as to the latter genus, it is easy to make a sharp distinction, because the segmented abdomen of *Hypochthonius* is not found in the adults of any other genus in the family, although indications of it may sometimes be seen in the very young larvæ. It is not by any means so easy to find any sharp dividing line between *Hermannia* and *Nothrus*, although such forms as *Hermannia picea* and *Nothrus spiniger* are extremely different; the real distinction lies mainly in the flat or concave notogaster and more or less oblong or shield-shaped abdomen of *Nothrus*, as compared with the arched notogaster and rounded abdomen of *Hermannia*. In treating of the last-named genus (page 439) I have already given my reasons for my distribution of the species between the two genera, and for being unable to agree in that of Berlese, and I will not repeat them here. Prof. Berlese seeks to overcome the difficulties of the typical and intermediate forms by erecting the latter into a sub-genus, which he calls *Angelia*. I do not think that it is desirable to follow this suggestion, in the first place because named sub-genera are inconvenient, and in the next place because it appears to me to double the evil, as it does not render it any easier to distinguish between *Angelia* and *Hermannia* than it was between the old *Nothrus* and *Hermannia*; and there is the new difficulty of distinguishing between *Nothrus* and *Angelia*, which Berlese does not seem to me to solve in any satisfactory manner.

There are probably few, if any, genera among the *Oribatidæ* in which it is more difficult to ascertain which are entitled to be treated as species and which as varieties than the present. The immature stages are very like the adults; and consequently, in closely-allied species, very like each other, and thus do not afford as much assistance in this respect as those of most other genera. Taking as the best example the four species *N. horridus*, *N. biverrucatus*, *N. bicari-*

*natus*, and *N. invenustus*, these creatures are very similar, and their parts, even to the hairs, are homologous, so that at first I was inclined to think that they might be all varieties of one species. I was, however, forced to abandon this idea because, on gathering a long series, it was evident that there were a number of small characteristics, each trifling in itself, but which broke up the series into perfectly constant groups; the four or five constituting, say, group A not being in any way connected by features, but being invariably found together; and none of them ever being found supplied with the characters included in groups B, C, or D. When once these small differences have been ascertained it is not difficult to identify the species, provided you can get the specimens clean enough to enable you to see them.

The genus is one in which the cuticle of the abdomen in most of the adults is not so hard nor so thoroughly chitinized as in other groups, consequently the creatures protect themselves either by carrying the cast notogastral skins, as *N. theleproctus*, or more frequently by piling dirt and débris upon their backs. This extraneous material appears to be attached by some glutinous secretion, which renders the process of cleaning very difficult unless such chemicals as sodium-hydrate be employed. The dirt adhering to the back doubtless also serves for concealment. They live very much at the roots of mosses, &c., and when one or two *N. horridus* or *N. biverrucatus* are placed in a cell with a little of the earth they were taken from it is extremely difficult to find them, even if the searcher has placed them there himself and knows that they must be there.

The **Rostrum** is generally short, sometimes slightly trifid (*N. theleproctus*, Pl. XLV, fig. 1, &c.), sometimes slightly truncated (*N. Targionii*, *N. horridus*, &c.). In the *horridus* group and some other species the rostrum is a very small, narrow, truncated cone, the cephalothorax widening suddenly behind it. The

rostral hairs are usually rather thick, sometimes curved, sometimes short and diverging.

The **Labium** is generally short and broad, often with a small median point (Pl. XLVII, fig. 2).

The **Epistome**, instead of being a mere thin edge, as it is in *Oribata*, *Notaspis*, &c., and indeed in most genera, becomes, in some species of this genus, widened out into a broad expansion, so that the labium does not occupy above half the width of the portion of the cephalothorax in which it is situated (Pl. XLV, fig. 2; Pl. XLVII, fig. 2). This produces, in many species, the sudden widening of the cephalothorax behind the rostrum (*N. horridus*, *N. biverrucatus*, *N. spiniger*) ; and this, being followed by a deep indentation for the insertion of the first pair of legs, gives a somewhat hammer-headed appearance to the cephalothorax.

The **Palpi**.—Nicolet states that in *Nothrus* the first joint of the palpus is the longest; he figures it so in his drawings; this would be quite exceptional in the *Oribatidæ*, but I am not able to confirm this observation. The small first (basal) joint seems to me to be present as usual, but in the typical species to be very small indeed; it is true that in such species as *N. spiniger* the portion of the labium from which each palpus springs is folded over so as to form an almost tubular support for, or continuation of, the palpus. Probably Nicolet regarded this as the first joint, and missed the small ordinary first joint, from its being minute and almost wholly sunk in the before-named tube; but if this tube were to be regarded as the first joint the palpi in all the *Oribatidæ* would have to be considered as six-jointed, with the first joint ankylosed to the labium, but I do not think that this has ever been asserted, nor do I think that it could be maintained. The palpus is generally almost cylindrical, but sometimes (*N. theleproctus*, *N. sylvestris*, &c.) the second joint is considerably enlarged; it is usually the longest. The terminal (fifth) joint is often furnished with strong papillæ, or even almost bifid (Pl. XLV, fig. 7; *N.*

*spiniger* is also a good example); the terminal joints are also often somewhat geniculate, and abundantly furnished with hairs (Pl. XLVI, fig. 3).

The **Maxillæ** are generally long and projecting, and usually sharply and deeply dentate (Pl. XLV, fig. 6; see also *N. spiniger*, where each maxilla has four teeth of the same character).

The **Mandibles** are short and broad, small in proportion to the size of the creatures; the chelæ are generally very curved, so that in some cases they only meet at the points (Pl. XLVIII, figs. 4, 9), sometimes the points even cross (Pl. XLVII, fig. 7). The dentition is usually carried by a median ridge on the inside of the chela (Pl. XLVIII, figs. 4, 9).

The **Lingua** is not, as a rule, particularly well developed, but is well seen in *N. biverrucatus*, &c., where each side terminates in a strong tooth or hook.

The **Pseudo-stigmata** are very large and projecting in most species, and the pseudo-stigmatic organs are mostly of one of two distinct types, either very short, with thin peduncles which project but little, and almost globular, or shortly pyriform heads (Pl. XLVII, fig. 9; Pl. XLVIII, fig. 5), or long and almost filiform (Pl. XLVI, figs. 4, 11); but in the group formed by *N. tardus*, *N. glaber*, and *N. monodactylus* no external pseudo-stigmata of the ordinary open tubular type are visible; and it is very doubtful whether the long setiform hair, which is present, is to be regarded as a pseudo-stigmatic organ or an interlamellar hair.

The **Lamellæ** are absent, or rather only represented by two quite rudimentary ridges or folds of the cuticle; although this is the case, the lamellar hairs not only persist, but assume very large dimensions, and in the typical species spring from long chitinous apophyses, which often project beyond the tip of the rostrum (Pl. XLVIII, figs. 1, 7; Pl. XLVII, fig. 2).

The **Tectopedia** are scarcely developed at all.

The **Apodemata** are singular but instructive; they

are mere infoldings of the cuticle, the two sides of which, being scarcely anchylosed, except just at the exterior, remain very loose and open. The cuticle of the sternal surface between these apodemata is bowed outward, giving the appearance of fixed coxæ, and they have been regarded as such by Nicolet and others, but dissection does not seem to me to support the idea, as they are only bendings outward of the same cuticle that is bent inward to form the apodemata, with which they are continuous.

The **Sternum** is usually scarcely developed at all, except as a flat or depressed portion of the cuticle.

The **Legs** are usually short, broad, and somewhat flattened, almost always rough; in a few species (as *N. palustris*, &c.) they are rather longer. The shortness of the legs attains its maximum in *N. monodactylus* (Pl. XLV, fig. 11), where the fourth pair scarcely reach beyond the commencement of the genital plates, and the third and fourth pairs are set quite under the abdomen. The first pair of coxæ in this genus, instead of being the spoon-shaped pieces almost wholly sunk within the acetabulum, which is the usual form in the family, are generally tubular projecting pieces, similar to the other joints. The coxæ of the third and fourth pairs, especially the latter, are, in some species, set upon tubular projections of the ventral surface (*N. palustris*, *N. sylvestris*, &c.). If these are to be regarded as projections of the ventral plate, as they probably are, then they are exceptional; if, on the other hand, they are to be regarded as fixed coxæ, they would be equally exceptional, and then we should have to admit that in these legs the trochanter is separate from the femur, as there are five free joints as usual. The femora are ordinarily the thickest and broadest joints, and have a short portion of the proximal ends much thinner and turned nearly at right angles. The genua and tibiæ are generally of about equal length; the tarsi vary very much, they are generally almost straight and more or less blunt-ended, and often have

a rounded chitinous elevation in the upper median line, near the distal end, bearing setiform hairs (Pl. XLVII, fig. 10). The claws are generally tridactyle, sometimes with the central unguis smaller than the others; but some species are monodactyle. The legs in most species are bordered by thick curved spines, which even are present on the tarsi.

The **Abdomen** is almost always flat, generally level or hollow on the notogaster, although there may be elevations and depressions. *N. theleproctus* appears less flat than other species, but this is partly in consequence of the mode of carrying the cast skins. The outline of the abdomen is generally more or less oblong (*N. horridus*, &c.), or else shield-shaped (*N. tardus*, &c.); its hind margin is apt to be provided with chitinous apophyses and other projections (Pl. XLVIII, fig. 7) which bear large spines or hairs. Similar structures are often found a little within the lateral and anterior margins, but they are usually small, although they attain a large size in *N. spiniger*. The lateral margins of the abdomen are generally raised.

The **Genital and Anal Plates** are always large, and generally close together; the former are usually pentagonal and the latter often come to a point posteriorly (Pl. XLVII, fig. 2).

The **Ventral Plate** is sometimes reduced to a mere strip; this is partly in consequence of the dorsal plate being much reflexed, or rather sufflexed, on to the ventral surface, and partly in consequence of the large size of the genital and anal plates and their proximity, so that but little space is left between them and the dorsal plate; but if some of these species, e. g. *N. horridus*, be dissected, it will be found that, in consequence of the imperfect chitinization of these parts, and the thickness of the membrane joining them, the ventral plate is far less distinct from the genital and anal than is the case in most genera.

The **Tracheæ** in such species as I have examined,

if present at all, are not of the ordinary type; they are short, thick vessels, irregular in shape, and with thick corrugated walls (Pl. D, fig. 11); these are described in vol. i, pp. 171, 172.

The **Cæca** of the ventriculus probably attain their maximum size in this genus (Pl. E, fig. 3). They often greatly exceed the size of the ventriculus itself and are generally sausage-shaped.

The **Expulsive vesicles** are generally well developed, and mostly discharge by a pore on the dorsal surface some little distance from the postero-lateral angle.

The **Ovipositor** is short and thick, but not so short as that of *Dameus*.

The **Hairs and Cuticle**.—In many species (*N. horridus*, *N. spiniger*, &c.) the large hairs arising from the anterior and posterior apophyses, and also sometimes the whole surface of the body, and even occasionally the smaller lateral hairs and most of those on the legs, are thickly set with short, blunt-ended, villous processes of the cuticle (Pl. XLVII, fig. 12); these processes are very easily rubbed off, and are usually matted up with dirt, so that they can only be properly seen in clean unrubbed specimens.

The **Nymphs** of this genus usually resemble the adults and would be supposed to be their immature stages; but they are of course monodactyle, and are less chitinized, have the abdomen lighter in colour, and what become apophyses in the adult are generally great mammilliform or papillary lobes in the nymph.

The **Adults** are very sluggish, moving extremely slowly. They are very generally distributed.

*Table to assist in the identification of British species of Nothrus.*

|                                             |                                                                                   |                                                                                                                                                                                                                              |                                                                                                                                                    |
|---------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Claws mono-dactyle                          | Abdomen not pointed posteriorly. Pseudo-stigmata of the ordinary type             | Hind margin of abdomen rounded, hairs thereon springing from apophyses                                                                                                                                                       | TARGONII.                                                                                                                                          |
|                                             | Abdomen shield-shaped (pointed posteriorly)                                       | Hind margin truncated, hairs thereon sessile                                                                                                                                                                                 | SYLVESTRIS.                                                                                                                                        |
|                                             | Abdomen shield-shaped (pointed posteriorly) no projecting tubular pseudo-stigmata |                                                                                                                                                                                                                              | MONODACTYLUS.                                                                                                                                      |
|                                             | Pseudo-stigmatic organs filiform                                                  |                                                                                                                                                                                                                              | PALUSTRIS.                                                                                                                                         |
|                                             |                                                                                   | Spines on lateral margin of abdomen as long as the width of the abdomen, and springing from large apophyses, which project far beyond the margin                                                                             | SPINGER.                                                                                                                                           |
|                                             |                                                                                   |                                                                                                                                                                                                                              |                                                                                                                                                    |
|                                             | Hind margin of abdomen not pointed                                                | Adults carrying any portion of the cast nymphal skin                                                                                                                                                                         | Hind margin without any central projection lower in level than the notogaster                                                                      |
|                                             |                                                                                   | Spines on lateral margin of abdomen short, no apophyses projecting beyond the margin                                                                                                                                         | Hind margin convex. INVENUSTUS.                                                                                                                    |
|                                             |                                                                                   |                                                                                                                                                                                                                              |                                                                                                                                                    |
|                                             | Pseudo-stigmatic organs elavate                                                   | Adults not carrying any portion of the cast nymphal skin                                                                                                                                                                     | Central projection with small tubercles at the corners, projecting outward and each bearing a large thick hair. HORRIDUS.                          |
|                                             |                                                                                   |                                                                                                                                                                                                                              |                                                                                                                                                    |
|                                             | Claws tridactyle                                                                  | Adults with a central projection lower in level than the notogaster                                                                                                                                                          | Central projection with very large, almost cylindrical, tubercles at the corners, each bearing a small sharply curved (curled) hair. RIVERBUCATUS. |
|                                             |                                                                                   |                                                                                                                                                                                                                              |                                                                                                                                                    |
|                                             |                                                                                   | Adults carrying the cast skins of the hind margin, and of the two long, conical, tail-like projections at the postero-lateral angles of the abdomen of the nymph, entirely enclosing the same parts of the adult as in a bag | SEGNIS.                                                                                                                                            |
|                                             |                                                                                   |                                                                                                                                                                                                                              |                                                                                                                                                    |
| Abdomen shield-shaped (hind margin pointed) | Adults large, and carrying cast nymphal and larval cast skins of the notogaster   | THELEPROCRUS.                                                                                                                                                                                                                |                                                                                                                                                    |
|                                             | Adults small, not carrying any cast skins                                         | Cuticle finely reticulated                                                                                                                                                                                                   | TARDUS.                                                                                                                                            |
|                                             |                                                                                   | Cuticle smooth                                                                                                                                                                                                               | GLABER.                                                                                                                                            |

NOTHRUS TARGIONII,\* *Berlese*. Pl. XLVII A, fig. 11.

*Nothrus Targionii*, Berlese. *Acari, &c. Ital.*, fasc. xvii, N. 8.

Average length about .83 mm.

Average breadth about .46 mm.

Average length of legs (first and fourth pairs) about .60 mm.

Average length of legs (second and third pairs) about .46 mm.

I have only a single specimen of this species. I unfortunately did not observe it during life; I am therefore forced, for the purpose of the plate and this description, to rely upon the mounted specimen and upon Berlese's figure and description.

This species probably approaches more nearly to the genus *Hermannia*, and especially to *H. bistrigata*, than any other *Nothrus* does: see the remarks on that subject in the description of the genus *Hermannia* (p. 439) and in the description of *H. bistrigata* (p. 462).

**Colour** dark-yellow, or reddish-yellow-brown; Berlese calls it "terreo-castaneus" (earthy chestnut).

**Texture.**—Cephalothorax irregularly pitted, pits about as wide as the intervening ridges. Abdomen smooth but not polished.

**Cephalothorax.**—Rostrum conical, tip truncated and slightly rounded. Rostral hairs stout, curved, rough. Behind the lamellar hairs the cephalothorax suddenly widens in consequence of the presence of a large, chitinous, mammilliform projection on each side; behind this projection the first pair of legs are set, so that the body appears deeply excavated for their reception; the homologue of the second tectopodium forms a large, slightly bifid, lateral projection on each side between the first and second leg. Placed between these last-named projections are a second pair of

\* Named in honour of Professor Targioni-Tozzetti.

mammilliform elevations on the dorsum of the cephalothorax, these elevations bear the pseudo-stigmata at their outer margins; between them the dorso-vertex is somewhat depressed, while it is raised between the anterior mammilliform projections. Pseudo-stigmata far apart, slightly raised. *Pseudo-stigmatic organs rather long, filiform.* Interlamellar hairs shortish, stout, curving forward. Lamellar hairs similar but considerably larger and covered with fine villous processes (which are found more or less on most of the hairs). Apodemata joined to the sternum.

**Legs** of moderate length; fourth pair slightly passing the hind margin; thick, gradually diminishing in thickness towards the distal end, but the femora, genua, and tibiae are slightly concave in lateral outline, enlarging rather sharply at the distal ends. The genua and tibiae are about of equal lengths, the femora longer; but the tarsi are the longest joints, as long or longer than the genua and tibiae together; they are excavated at the end to allow the stout single claw to fall back. The legs are fringed with thick curved hairs, which are covered with villous projections like the lamellar hairs, or furnished with a thin membranous edge; they mostly arise from small, chitinous apophyses, and in arrangement are about as follows:—four on the outside of each third coxa; three or four on each side and one on the top of each femur, and a second row of three or four on the outer side of each first and second femur below the first line; one on each side of each genua and tibia, near the proximal end; and three to five on each side of each tarsus; there is also a row of about four spikes underneath each tarsus. Tactile hairs very small, a few fine hairs on the tarsi, &c. *Claws monodactyle.*

**Abdomen** hollow in the middle, somewhat raised at the margin. Progaster nearly straight, lateral margins curving slightly outward so as to be widest not far from the hind margin; *hind margin rounded*, it bears four large and two small chitinous apophyses, and there

are two higher in level, from each of these springs a large curved hair similar to the lamellar hairs. There are four similar hairs, but smaller, on each lateral margin, and two diverging longitudinal rows, each of three very small hairs, on the notogaster. The dorsal plate is greatly sufflexed on to the ventral surface, where it is much arched in the middle, leaving the hind margin projecting as a thinner shelf at the sides. Ventral plate very small and triangular; almost or quite separated into two paired pieces, each of which has a sharp point directed inward somewhat in front of the middle of the anal plate. Genital and anal plates almost touching; the former large and pentagonal, the latter long and narrow, with two small lateral projections anteriorly, then constricted, then curving outward and coming to a point posteriorly (amphora-shaped).

**Distribution.**—I have only one specimen, found in a mole's nest in Warwickshire. Berlese found it at Rua in Italy in moss.

NOTHRUS SYLVESTRIS,\* *Nic.* Pl. XLVI, figs. 1—7.

*Nothrus sylvestris*, Nic. P. 458.

— *Anauniensis*, Can. e. Fan., p. 24, Tav. 1, fig. 2.

— — — Berlese. Acari, &c. Ital., fasc. xvii, pl. vii.

— *biciliatus*, — — — Notes, fasc. 3, p. 11.

Average length about .66 mm.

Average breadth about .30 mm.

Average length of first pair of legs about .41 mm.

Average length of second and third pairs of legs about .30 mm.

Average length of fourth pair of legs about .48 mm.

This is a clean and rather handsome species, it has a considerable resemblance to *N. palustris*, although

\* *Sylvestris vel. silvestris*, of the woods.

very easily distinguished from it. Professor Canestrini is, in my opinion, entirely in error in identifying this species with *N. palustris* ('Prospetto dell'Acaro-fauna Ital.', p. 30). Prof. Berlese seems to me to be equally in error in stating this species to be the *N. biciliatus* of Koch. For the identity of *Nothrus sylvestris* and *N. Anauniensis*, I rely entirely on Berlese, who has had ample opportunity of examining Professor Canestrini's specimens and states them to be identical.

Both Canestrini and Berlese state this species to be didactyle, with one claw much smaller than the other; I do not think that this is correct; hairs and claws are of course processes of somewhat similar natures in these creatures, and it is often difficult to distinguish between them. In the present instance, if the whole creature be looked at, there is something that looks much like a small second claw, but if the tarsi be carefully dissected off and examined with a high power, it will be seen that the supposed second claw proceeds, not from the clear chitinous rod at the end of the tarsus, which always bears the claws in the *Oribatidae*, but from the tarsus itself. I am, of course, supposing that the learned Italian professors really had the *N. sylvestris* of Nicolet under examination.

**Colour** light chestnut-brown.

**Texture** dull and reticulated all over, the fineness of the reticulations varies in different parts of the body.

**Form** almost a parallelogram, but the sides are slightly curved and the rostrum is bluntly pointed.

**Cephalothorax** darker in colour than the rest of the creature, rough, finely reticulated (reticulations about 125 to the millimètre, pits three or four times as wide as the ridges). Rostrum with a blunt rounded point; then the cephalothorax slopes outward at an obtuse angle for nearly half its length, after this it becomes more parallel-sided, but is indented for the insertion of the first pair of legs, and finally it swells out again, with a rounded outline on each side. These rounds are formed by the bases of two almost hemispherical

elevations of the posterior part of the cephalothorax; the pseudo-stigmata are situated on these elevations. Between the two is a longitudinal sulcation extending from the base of the cephalothorax to the commencement of the sloping portion of the rostrum. Pseudo-stigmata rather near together and rather small. Pseudo-stigmatic organs long, curved (either backward or forward), filiform, rather thick. Interlamellar hairs much shorter, and rather thicker than, but otherwise resembling, the pseudo-stigmatic organs. Two smaller hairs of the same nature represent the lamellar hairs [these are omitted in the plate]. Rostral hairs short and curved. Apodemata joined to the sternum.

**Legs** of medium length, stout; the fourth pair passing the hind margin by about one half of the length of the tarsi. Coxæ of the two hind pairs of legs large and globose, all the femora turned almost at right angles before insertion into the coxæ. The coxæ of the third and fourth pairs of legs are inserted into almost tubular projections of the sternal plate. Each joint, except the coxæ and tarsi, bears a whorl of short, curved, thick white hairs. The tarsi have the usual fine hairs. Claws monodactyle.

**Abdomen** almost a parallelogram, but the margins are slightly curved. The lateral margins are formed by broad raised bands, which stand at an angle of about forty-five degrees near the progaster, but become flatter near the posterior margin, where they widen out and become almost merged in the general body surface. These lateral bands are finely reticulated (reticulation about the same as that of the cephalothorax). The progaster is formed by a smaller raised band similar to the lateral but narrower. Inside the lateral bands the notogaster is arched, but it does not attain any level higher than the outer edges of the lateral bands. This central portion is much more coarsely and irregularly reticulated than the bands; reticulations about sixty to the millimètre, pits four to

six times as wide as the ridges. There is a small rounded projection below the hind margin. There are four longitudinal rows of about five thick, curved, rather spatulate, slightly imbricated, white hairs on the notogaster (two being on the central part and one on each raised margin), one longer similar hair on each postero-lateral angle; two pairs of shorter similar hairs on the hind margin, and one pair on the lateral margin, a little in front of the posterior angle; there is also a short hair inside the antero-lateral angle. Notogastral plate greatly sufflexed on to the ventral surface. Ventral plate merely a narrow band. Genital and anal plates near together but not touching, the former shortish and almost round, the latter long and narrow; there is a triangular chitinous piece between the two.

*Nymph.*

**Colour** of cephalothorax and legs red-brown, of abdomen yellowish-white.

**Texture** of cephalothorax reticulated as in the adult, of the abdomen dull, thickly set with raised dots, which give it the appearance of shagreen.

**Cephalothorax** very like that of the adult [the rostral and interlamellar hairs are omitted in the plate].

**Legs** very similar to those of the adult, but a little shorter in proportion; the tubular projections of the sternal plate, into which the third and fourth coxae of the adult are inserted, are not present in the nymph.

**Abdomen** nearly oblong, but the margin slightly sinuated. Progaster nearly straight, with the angles very slightly rounded; wider than the cephalothorax, and raised much above it. A broad lateral margin on each side of the abdomen is considerably raised, and slopes down to a furrow, from whence the central part of the notogaster rises in a slight arch. The postero-lateral angles of the abdomen are quite sharp or slightly projecting; each bears a thick, curved, blunt

hair. Posterior margin slightly concave, but below the concave line projects a narrower portion, also with sharp or projecting angles, bearing similar hairs and having a concave posterior margin. There are a pair of smaller similar hairs between the two above-named and further from the posterior margin, one on each side on the lateral margin, somewhat anterior to the postero-lateral angle; four on each lateral raised margin, and four on the progaster. There are also two longitudinal rows, of about four similar hairs each, on the notogaster.

**Distribution.**—Generally distributed, but not very abundant. The species has been recorded in France and Italy.

NOTHRUS PALUSTRIS,\* Koch. Pl. XLVI, figs. 8—13.

- *Nothrus palustris*, Koch. Heft 29, fig. 13.
- — Nic. P. 457, pl. vii, fig. 6.
- — Haller. Milbenfauna Würtembergs, p. 306.
- — Berlese. Acari, &c. Ital., fasc. xxx, pl. iv.
- *pallens*, Koch. Heft 38, fig. 4, Nymph.
- — Can. e Fan., p. 25, pl. i, fig. 4, Nymph.

Average length about 1·05 mm.

Average breadth about ·60 mm.

Average length of legs (first pair) about ·65 mm.

Average length of legs (second pair) about ·50 mm.

Average length of legs (third pair) about ·58 mm.

Average length of legs (fourth pair) about ·85 mm.

A large, handsome, clean, and well-marked species.

**Colour** dark red-brown.

**Texture** rough and dull, central parts coarsely pitted (pits about 85 to the mm., and rather wider than the ridges between them); peripheral parts somewhat finely granular (granulations about 140 to

\* *Palustris*, of a marsh.

the mm., and about twice the width of the dividing depressions).

**Shape** nearly oblong.

**Cephalothorax** more than a fourth of the whole length. Rostrum rather pointed, widening gradually to the first pair of legs, lateral margin straight, but there are two slight indentations in it on each side. There are deep and sharp excavations immediately behind the rostrum for the insertion of the first pair of legs ; behind them the cephalothorax increases considerably in breadth, but has a rounded lateral margin ; it is nearly as wide as the progaster, where they abut on each other. There is a rough transverse ridge across the base of the rostrum, probably the homologue of a translamella, and behind this are two large, parallel, longitudinal ridges or rolls, a transverse section of one of these would be almost circular. These rolls end posteriorly in domed elevations which bear the pseudo-stigmata near their postero-lateral parts. These pseudo-stigmata are rather large and almost upright. *Pseudo-stigmatic organs very long, as long as the cephalothorax or longer, filiform, directed almost outward, but usually doubly curved, the proximal curve concave, and the distal convex as seen from the front.* Interlamellar hairs short, spike-like, very close to the pseudo-stigmata. No first tectopodium ; the second forms a blunt bifid projection behind the insertion of the first leg. Rostral hairs short and curved. Lamellar hairs, or what represents them, short, straight, near together, directed straight forward. Apodemata joined to the sternum.

**Legs** long for the genus, moderately thick, gradually tapering ; most joints with a slight median constriction, behind which the thick hairs are inserted. Femora of the two front pairs with thin, short, proximal ends set at an angle of about  $45^{\circ}$ . Genuals as long as the tibiæ. Tarsi far the longest joints ; gradually diminished toward the distal ends, which are rather blunt. The fourth legs of this species and the allied

*N. sylvestris* exceptional, inasmuch as they are articulated in large, tubular projections of the hinder divisions of the sternal (or ventral) plate, as mentioned in the descriptions of the genus. All the legs are rough and granular. There are the following thick, slightly curved, white hairs on the legs, viz. an irregular whorl of three on each femur of the first two pairs, another on the outer edge nearer the proximal end of that of the second leg; two, one inside, the other outside, on each genual and tibia of the first two pairs of legs; one outside each joint except the tarsus of the third leg and each of the three central joints of the fourth leg; three outside each tarsus, and two or three inside that of the first leg. On the inside of the joints of the hind legs the thick hair is often replaced by one that is fine and short. The tactile hairs are small. Tarsi sparsely furnished with fine hairs. Claws tridactyle, very heterodactyle.

**Abdomen** almost oblong, but slightly wider posteriorly than anteriorly; its lateral margins somewhat curved and considerably raised, terminating posteriorly in large rounded bosses, which fill the postero-lateral angles of the notogaster. A marked depression divides the raised margin from a somewhat arched oval, which fills the central part of the notogaster, and is coarsely reticulated (size of reticulations given above). Progaster raised, almost straight. Hind margin almost straight at the dorsal level, but with a rounded projection below bearing a pair of thick hairs. Each postero-lateral angle of the notogaster bears a very long and powerful setiform hair, directed backward, and curved, with the concavity inward; these hairs are two-thirds the length of the abdomen. There is a shorter but stout spine near the inner edge of each of the bosses, directed backward and curving outward, one on each lateral margin near the anterior corner of the boss, and two or three smaller hairs inside the margin further forward. There are two longitudinal, curved rows of five hairs on the median part of the

notogaster. Genital and anal plates very large, almost touching, and extending nearly the whole length of the abdomen. Anal plates long, narrow, curved exteriorly; genital plates almost circular, set in a pentagonal opening. Ventral surface granular.

*Nymph.*

This creature is so like the adult that it could not be mistaken. It would be waste of space to describe it fully; I shall merely point out the differences from the perfect form.

**Colour** of cephalothorax and legs light reddish-brown, of abdomen yellowish-white.

**Cephalothorax.**—The two longitudinal rolls are less conspicuous than in the adult.

**Legs.**—The coxae of the first two pairs are more visible than in the adult.

**Abdomen** flatter than in the imago, median part and margin not raised. Progaster rather concave; *postero-lateral angles produced* so as to form large, conical tails, which bear the great hairs. Central projection and pair of hairs not always seen from above. Notogaster granular, markings of the same size all over it.

**Distribution.**—Found in moss on the ground, generally distributed, not uncommon. It has been recorded in France, Germany, and Italy.

NOTHRUS SPINIGER,\* Koch. Pl. XLVIII, figs. 7—13.

*Type species.*

*Nothrus spinifer*, Koch. Heft 2, fig. 18.

— — Can. e. Fan., p. 28.

— — G. Canestrini Acarofauna Ital., p. 32.

— — Berlese. Acari, &c. Ital., fasc. xvii, pl. iii.

— *spiniger*, Nic. p. 455.

\* *Spina*, a thorn, spine; *gero*, I bear.

Average length about .84 mm.

Average breadth about .40 mm.

Average length of legs (first pair) about .50 mm.

Average length of legs (second and third pairs) about .38 mm.

Average length of legs (fourth pair) about .44 mm.

This is Nicolet's type species, and I do not see that a better type of the genus could be found.

A species remarkable for the length and size of the curved hairs or spines, bordering the abdomen, and of the apophyses from which they spring.

**Colour** moderately dark, chitinous-brown ; the creature, however, is usually so covered with dirt that it is seldom that the real colour or texture can be seen, except immediately after emerging from the nymphal skin.

**Texture** rough and covered with short villous processes, looking granular ; without any polish, usually rather leathery.

**Shape** oblong.

**Cephalothorax** the full width of the abdomen. Rostrum rather blunt ; rostral hairs short, curved, covered with villous processes, and springing from short apophyses. There is a somewhat square projection before the insertion of the first leg on each side, and the coxae of these legs are inserted in deep indentations. There are two short, ill-defined, widely-separated ridges running forward from about the middle of the cephalothorax, and in front of these are two long chitinous apophyses, or tubes, extending considerably beyond the rostrum ; each bears a long, stout, curved spine or hair ; the two from the opposite sides cross beyond the rostrum. The spines and apophyses are covered with villous processes. Pseudo-stigmata very projecting tubes. Pseudo-stigmatic organs small, with shortly pyriform, almost globular heads on very short peduncles. Interlamellar hairs very long, thick, slightly curved, covered with villous processes ; they spring from short apophyses.

**Legs** thick, broad, flattened, rough. Hind pair scarcely passing the posterior margin, most joints of the legs slightly increasing toward the distal end. Tarsi with the usual fine hairs. Each of the other joints has very thick, sharply curved hairs of moderate length; there are usually four on the outside of the third coxa, three to five on the outside and one to four on the inside of each femur; one or two on each genual and tibia, except the inside of the fourth; three or four on each side of each tarsus, and one on the top of almost every joint. *Claws tridactyle.*

**Abdomen** oblong. The progaster and the lateral margins are raised; the hind margin, slightly and sharply depressed, leaving a raised curved ridge forming the anterior margin of the depression. The central portion of the abdomen (along the median line) also has a tendency to be slightly raised, but not regularly so; it is broken by shallow depressions, so as to form several ill-defined swellings, which, however, seldom attain the level of the lateral edge. Along the progaster are three pairs of stout curved hairs or spines; the exterior pair are the most sharply curved; each hair crosses its fellow of the same pair from the opposite side; these hairs spring from short apophyses and are covered with villous processes. Along each lateral margin are placed five long, slightly recurved chitinous apophyses, which project far beyond the margin; each one terminates in a very long and stout recurved hair or spine, more or less flexible, and with villous processes in perfect specimens: these apophyses are placed, one at the antero-lateral angle, two close together near the postero-lateral angle, and two about equidistant from the angles and each other. At the actual postero-lateral angle is a large projection, somewhat bulbous in form, terminating in a straight chitinous projection, or apophysis, with a large, straight, terminal spine; from the inner side of this projection, just at its junction with the hind margin, springs another chitinous apophysis with a stout, terminal, curved spine. There is

another smaller pair of apophyses with curved terminal spines, lower in level, and nearer to the median line. There are three pairs of shortish, curved, rod-like hairs on the notogaster; many of these are generally rubbed off or hidden by dirt. Genital and anal plates close together, the former almost pentagonal, not much wider than the latter, which are pointed posteriorly. Dorsal plate much sufflexed on to the ventral surface; ventral plate very narrow.

It must be remembered that the villous processes are usually rubbed off, or concealed by dirt, and that much of the above detail can only be seen in cleaned specimens.

### *Nymph.*

The nymph is extremely like the adult, and can be at once known; the differences are its softer cuticle, lighter colour, which is pale drab, sometimes yellowish-white, its slightly more arched notogaster, monodactyle claws, and that the rostrum and all other parts are softer and less angular in outline, and the apophyses from which the great spines arise are not so long or chitinous as those of the adult, but spring from large mamilliform elevations.

**Distribution.**—Generally distributed, but I have not ever found it very abundant. The species has been recorded in Germany, France, and Italy.

NOTHRUS INVENUSTUS,\* sp. nov. Pl. XLVII<sub>A</sub>, fig. 12; Pl. XLVII, fig. 6.

Average length about ·66 mm.

Average breadth about ·33 mm.

Average length of legs (first pair) about ·30 mm.

Average length of legs (second pair) about ·24 mm.

Average length of legs (third pair) about ·27 mm.

Average length of legs (fourth pair) about ·33 mm.

\* *Invenustus*, unhandsome.

A species constituting one of the group which closely resemble *N. horridus*. It may be distinguished from the othermembers of that group by the convex posterior margin of its abdomen, its shorter legs, shorter apophyses on the rostrum, &c.

**Colour.**—I have not ever seen this species in life, but from the preparations I should presume it to be brown, of medium depth. I am informed by the discoverer (Mr. Bostock) that the creatures were not covered with dirt.

**Texture** rough and dull ; the creature is covered with short villous processes of the cuticle, which are easily rubbed off but when *in situ* give a granular appearance ; they are not so large nor so well marked as the similar processes in *N. horridus*, &c.

**Cephalothorax** narrower than the abdomen, but not conspicuously so. Rostrum small, conical, slightly truncated. Genæ very distinct. Rostral hairs almost straight. Behind the rostrum the cephalothorax widens and rises, forming a transverse edge somewhat bowed forward ; after a short distance it narrows again suddenly, being deeply excavated for the insertion of the first pair of legs. From immediately behind the before-named transverse edge spring two chitinous apophyses, bulbous at the proximal end, and having *very short* cylindrical distal ends, *very much shorter than those of N. horridus*, &c. ; they do not come near the tip of the rostrum ; each of these apophyses bears a thick hair closely set with short villous processes. These hairs usually touch or cross. Pseudo-stigmata very projecting. Pseudo-stigmatic organs *very short*, with thin peduncles and *small, almost globular heads*, rough at the ends. There are two strong oblique ridges springing from near the pseudo-stigmata, which look like rudimentary lamellæ. Interlamellar hairs long, fine, setiform.

**Legs** short, the fourth pair not reaching the hind margin ; rather thick, rough, gradually diminishing in thickness, but each joint is slightly enlarged at the

distal end. From the dorsal aspect the coxæ of the third pair are hidden by the abdomen. Genuals and tibiae of about equal length; the tarsi are the longest joints. The legs are furnished with one or two whorls of short, curved, almost hooked hairs, on each joint except the coxæ and tarsi; the inner hair of the whorl is absent in the two hind pairs of legs. *These hairs hardly seem to spring from apophyses*, although they do arise from very slight elevations. There is a bunch of rather long setiform hairs springing from a rounded elevation in the upper median line near the distal end of each tarsus. Claws *tridactyle*, almost homodactyle.

**Abdomen** oblong, raised above the cephalothorax. Progaster rather convex; *hind margin decidedly convex*, it bears three pairs of apophyses, from each of which springs a large curved hair covered with short villous processes. The largest of these is the most anterior, and is set on the actual edge, the next pair is further from the edge and is set on the hinder, almost perpendicular part of the rounded lobe below mentioned; the third pair are nearer the median line, and a little within the edge. A pair of much smaller similar hairs, not springing from apophyses, project from the ventral surface. The general level of the notogaster is flat, but there are some elevations and depressions, viz. a slightly depressed space in the median line is bordered by a raised ridge. The space is not defined anteriorly, nor does the ridge run round the anterior side, but it commences near the progaster, and is there about a fifth of the width of the abdomen; it continues more or less parallel-sided for about three-fifths of its length, then there is a very slight constriction; from this point it widens rapidly, and at its hind margin is about twice as wide as anteriorly. Near the constriction the two sides are joined by a slighter, transverse, curved ridge. A diagonal ridge runs outward and backward from each posterior corner of the main ridge. There are three pairs of

very small apophyses, bearing short, thick, villous hairs just outside the main ridge; the third of these is in the above-named constriction, and *the first and second are nearer together than the second and third*. A similar apophysis and hair is placed just behind each of the two diagonal ridges. Outside the lateral parts of the main ridge the abdomen is concave, it then rises again, forming a broad, raised, rounded margin, the extreme edge of which is not the highest part. This raised edge bears a few irregular, more or less transverse ridges, and also, on each side of the body, four short, thick, curved hairs. The posterior ends of these raised lateral margins widen out a little and form large rounded lobes or bosses which project farther back than the space enclosed by the ridge; between these lobes and behind the ridge the dorsal surface of the abdomen is much depressed, so as to seem scooped out like the bowl of a spoon, the hind margin being thin. The progaster is raised, and bears three pairs of short curved hairs. Genital and anal plates large and close together, the former much the wider, the latter longer and coming to a point posteriorly.

**Distribution.**—I only know of this species from four or five specimens found by Mr. Bostock in lichen on Clifton Bridge, and sent to me after being mounted in balsam, and one specimen found by Mr. M. J. Michael at Malvern.

NOTHRUS HORRIDUS\* (*Herm. père*). Pl. XLVII, figs. 1—4 and 7—13.

*Notaspis horridus*, Hermann. P. 90, pl. vi, fig. 3.

*Oribata horrida*, Gervais. P. 254.

*Nothrus horridus*, Koch. Uebersicht, p. 113.

— *mutilus*, — Heft 29, fig. 18.

— *bistriatus*? — Heft 29, fig. 21.

— *angulatus*? Berlese. Acari, &c. Ital., fasc. xvii, fig. 5.

— *sinuatus*, Koch. Heft 29, fig. 22 } Nymphs.

— *runcinatus*, — Heft 29, fig. 23 }

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\* *Horridus*, rugged, horrible, hideous.

Average length about .80 mm.

Average breadth about .42 mm.

Average length of legs (first and fourth pairs) about .49 mm.

Average length of legs (second and third pairs) about .39 mm.

This species does not appear to be the *Nothrus horridus* of Nicolet or Berlese.

I have found this to be one of the most puzzling and difficult species to elucidate ; probably most students of the genus will have the same experience. A careful study of Hermann's work, and of the various later works in which this and the allied species are treated of, and also of a long series of specimens of various allied forms (including the one here treated of), both in life and in various modes of preservation and, also of specimens which Professor Berlese has been good enough to send me, both of his *N. horridus* and his *N. angulatus*, have led me to the conclusion that the species here described is the true *N. horridus* of Hermann, and that the above is, as far as I can judge, the correct synonymy.

It will be observed that I have put a query to the last two synonyms of adults. It is very difficult to say whether Koch's *N. bistriatus* is this species or not ; I incline to think that it is not. With regard to Berlese's *N. angulatus* the specimens which he sent me, and which he considers to be Koch's *N. angulatus* (an opinion in which I am not able to agree), are certainly very like this species ; but there are some small differences, and all the specimens he sends are alike, while all mine are also alike. Firstly, although the measurement which he gives in his book agrees with my specimens, yet his specimens are larger. I do not think much of this, as Italian specimens might well be larger than English, but he does not show or mention any hairs on the oblong central carination of the notogaster, although he draws them on the allied

species, *N. bicarinatus*, where they are much less conspicuous, nor can I see any on his specimens. I might miss them as the specimens are not cleaned, but in my specimens they spring from rather strong, chitinous apophyses, which would not be so likely to be missed, and which are not drawn nor mentioned, nor can I see them. Then, Berlese draws a second longitudinal carination on the notogaster, which my specimens do not possess, and his smaller transverse carinations are much more regular than in my specimens ; the abdomen in his drawing is longer and narrower in proportion, and there are a few other trifling differences.

The *Nothrus horridus* of Nicolet is distinguished by having two long, diverging setiform hairs springing from each of the apophyses which form the outer angles of the central projection below the hind margin. Hermann does not draw or mention these ; he may have missed them, but probably would not have done so if they were as conspicuous as Nicolet figures them ; it was perfectly natural that Nicolet, who only knew of one form that could be supposed to be Hermann's *N. horridus*, should identify it with that species. Berlese ('Acari, &c. Ital.,' Notes, fasc. iii, p. 6) states that he has found specimens agreeing exactly with Nicolet's drawing, and he figures this species as *N. horridus* in the same work (fasc. xvii) ; it shows the two hairs on each of the above-named apophyses, but the apophyses themselves and a few other particulars seem rather different from Nicolet's. Berlese, in his book, states his *N. horridus* to be more than one-third longer than his *N. angulatus*, and this larger size agrees exactly with Nicolet ; but the specimens which Professor Berlese sent me as his *N. horridus* and his *N. angulatus*, are the same size (unfortunately the hairs are gone from the hind margin of the former). I have not ever seen in England any specimen with the two hairs from each of the central hind apophyses nor with hairs of the size or form figured by the French and Italian

writers, but I have found a few specimens of a species which agrees with Berlese's figure of his *N. horridus*, except that mine has only a single small hair on each apophysis. I believe this species not to be Hermann's *N. horridus* but Koch's *N. biverrucatus* which, I think is distinct; I have figured it under that name. Whether the species with the two hairs is a variety of the same I am not able to say.

**Colour** brown, of median depth; the creature, however, usually covers itself up with dirt to such an extent that the colour cannot be seen, nor, indeed, can the texture or markings; and if reagents be used to remove the dirt they may modify the colour.

**Texture** rough and dull; the whole creature is thickly strewn with irregular, short, villous processes of the cuticle, which are easily rubbed off, but when *in situ* give a rough and granular effect.

**Cephalothorax** partly hidden beneath the progaster; the part which shows from the dorsal aspect is considerably narrower than the abdomen. Rostrum small, conical, slightly truncated; genæ very distinct; rostral hairs diverging and almost straight. Behind the rostrum the cephalothorax suddenly widens and rises, forming a strong transverse edge slightly bowed forward; after a short distance it narrows again, being deeply excavated for the insertion of the first pair of legs. From immediately behind the before-named transverse edge spring two large chitinous apophyses, bulbous at their proximal and more cylindrical at their distal ends, which reach nearly to the tip of the rostrum. Each of these apophyses bears a large thick hair, closely set with short villous processes; these hairs are straight at first but curve inward at their distal ends and generally cross. Pseudo-stigmata very projecting, close to or partly under the progaster. Pseudo-stigmatic organs *very short* with thin peduncles, which project but little from the pseudo-stigmata, and *small, almost globular heads*, rough at the ends. There are two curved longitudinal ridges springing from

near the pseudo-stigmata, which look rather like rudimentary lamellæ. Interlamellar hairs long, fine, setiform, very difficult to see. The two first pairs of apodemata long; sternum scarcely developed.

**Legs** of moderate length, the fourth pair very slightly passing the hind margin; thick, rough; gradually diminishing in thickness, but each joint is slightly enlarged at the distal end. From the dorsal aspect the coxæ of the second and third pairs are entirely, and those of the fourth almost, hidden by the abdomen. Genuals and tibiæ of about equal length; the tarsi the longest joints. The legs are furnished with short, thick, curved, almost hooked hairs, *each of which springs from a small but very distinct chitinous apophysis*. They are arranged about as follows, viz.: two on the outside of each femur and two on the inside of those of the first and second pairs; one on the outside of each genual, two on the outside of each tibia; and one on the inside of each of these joints in the first and second pairs of legs; four or five on each side of each tarsus, and one on the upper surface of each joint. The tarsi have the usual fine hairs. Claws tridactyle, almost homodactyle, but the central claw the shortest.

**Abdomen** oblong, raised above the cephalothorax. Progaster slightly convex, hind margin with a small concavity on each side, at the inner angle of which is a chitinous cylindrical apophysis bearing a large rough, spatulate, curved hair; a smaller similar hair projects from the ventral surface about the middle of this concavity. *Between the two apophyses the hind margin forms one large concavity, the greater part of which is occupied by a median flat projection from nearer the ventral surface; this projection has sides sloping backward and inward, and a concave hind margin; at each outer corner it bears a hair, similar to those last named, springing from an apophysis.* Lateral margin straight in general outline but with an irregularly indented edge. The general level of the notogaster is flat, but there are elevations and depressions as follows: viz. a more

or less oblong space in the median line is slightly depressed ; it is bordered on all sides by a conspicuous raised ridge, which is generally somewhat curved anteriorly and posteriorly, more straight laterally ; but there are two slight constrictions in the lateral ridge (on each side of the body) ; near these constrictions the two lateral ridges are joined by a thinner transverse ridge, generally curved, and a diagonal ridge runs outward from each outer corner of the oblong. *Three small chitinous apophyses*, each bearing a very small, curved, spatulate hair, stand horizontally outward from the outer edge of each of the lateral ridges, the first placed just behind the junction with the anterior diagonal ridge and the others in the two constrictions ; *the first and second of these apophyses are nearer together than the second and third*. A similar apophysis and hair project from the hinder edge of the postero-diagonal ridge. Outside the lateral ridges of the above-described oblong the abdomen is decidedly concave ; it then rises again, forming a broad, raised, rounded margin, the extreme edge of which is not the highest part ; this raised edge bears a few irregular, more or less transverse ridges, and also (on each side of the body) three small chitinous apophyses, each bearing a short, curved, spatulate hair ; *the apophyses do not project beyond the lateral margin of the body*. The pore of the expulsive vesicle is near the last of these apophyses but a little closer to the median line. There are six similar apophyses and hairs by the pro-gaster. All the hairs springing from apophyses on this creature are thick and covered with villous processes or membranous fringes. Genital and anal plates large and close together, the former the wider and almost pentagonal ; the latter longer and coming to a point posteriorly.

#### *Nymph.*

I believe the creature here described to be the nymph of *N. horridus* ; but, as at the time when I bred it I

did not consider *N. horridus*, *N. bicarinatus*, and *N. biverrucatus* to be three separate species, I am not absolutely certain to which the nymph belonged. I have not had an opportunity of breeding it since.

This singular and extremely dirty nymph was made into two distinct species by C. L. Koch, who evidently did not suspect that they were only immature stages; his *N. runcinatus* and *N. sinuatus* are clearly only nymphs at different ages. Nicolet pointed this out.

**Colour.**—A dirty yellowish white, varying to pale ochre-colour, the legs and cephalothorax are redder; the whole creature, however, is frequently so covered with dirt and extraneous matter sticking to it that it is difficult to see either colour or shape.

**Texture** granular, when it can be seen.

**Cephalothorax.**—The *rostrum* is really short and much curved downwards; it is, however, usually entirely concealed by a strange-looking projection, which appears like a long-pointed shelf, but is really formed of the two long interlamellar hairs stuck together at the points, and their whole surface coated, and the triangular space between them filled up, with dirt and some dried mucous secretion, which forms a thin translucent plate between the two hairs; the projection stands quite free in air, except at its proximal edge, and ends in a long, turned-up, blunt point or knob, where the two hairs are stuck together. This is the condition in which it is drawn (Pl. XLVII, fig. 3).

The cephalothorax behind the rostrum is divided into two rolls or divisions, the anterior considerably the narrower, and bearing the pseudo-stigmata; the pseudo-stigmatic organs resemble those of the adult.

**Legs** thick and straight, the hind pair considerably shorter than the body; the femora are very rough and marked with ridges and little rugosities. There are one or more whorls of short, thick, sharply-curving hairs on each joint of the legs. The usual tactile hair on each front tibia, and fine hairs on the tarsi.

**Abdomen** oblong, the sides being parallel, and the

corners nearly right angles ; it is somewhat raised at all the margins, a little depressed in the centre, and being considerably thicker than the cephalothorax its progaster rises almost perpendicularly from the cephalothorax. Each lateral margin bears four large, irregular-shaped lumps, or exaggerated papillæ ; each bearing a short, stout, recurved hair, which usually looks thicker than it is from the dirt sticking to it ; a similar papilla, but still larger, forms each posterior angle, and between these are two somewhat smaller papillæ, nearer to the ventral surface, and seated upon a depressed margin or ridge. There are six short thick hairs along the progaster, and two longitudinal rows of three papillæ, each on the notogaster, each papilla bears a thick curved hair.

**Distribution.**—The species is generally distributed ; it is found in moss, at the roots, and amongst fallen vegetable matter. It is remarkably sluggish and awkward in its movements, both in the nymphal and adult stages. It has been recorded in Switzerland, Germany, and possibly in Italy.

#### NOTHRUS BIVERRUCATUS,\* Koch. Pl. XLVII A, figs. 6—10.

*Nothrus biverrucatus*, Koch. Heft 29, fig. 15.

— *angulatus*, — Heft 29, fig. 14.

— *horridus* ?, Nic. P. 456.

— — ?, Berlese. Fasc. xvii.

Average length about 1·0 mm.

Average breadth about ·48 mm.

Average length of legs (first and fourth pairs) about ·60 mm.

Average length of legs (second and third pairs) about ·40 mm.

This species may be distinguished from *N. horridus* by its larger size, the shape of its hind margin, and its

\* *Bis*, twice; *verruca*, a wart.

smaller hairs. As to whether it is really the *N. horridus* of Nicolet and Berlese, see my remarks when treating of *N. horridus* (p. 505). I am rather inclined to think that it is not, as, although there is a very great resemblance to Berlese's drawing, the single very small curly hair on the great posterior papilla is so different from the two great hairs which both he and Nicolet figure and describe, that I cannot say that the species are identical; but the hair on my specimens precisely agrees with Koch's figure and descriptions of his *N. biverrucatus*.

**Colour** brown, of medium depth; the creature, however, usually covers itself up with dirt to such an extent that neither colour, texture, nor markings can be seen.

**Texture** rough and dull; the whole creature is thickly strewn with irregular, short, villous processes of the cuticle, which are easily rubbed off, but when *in situ* give a rough and granular effect.

**Cephalothorax** partly hidden beneath the progaster, very little narrower than the abdomen. Rostrum small, conical, slightly truncated; genæ distinct; rostral hairs diverging, almost straight. Behind the rostrum the cephalothorax suddenly widens, and rises, forming a strong transverse edge slightly bowed forward; it then narrows again, being deeply excavated for the insertion of the first pair of legs. From immediately behind the before-named transverse edge spring two large chitinous apophyses, convex on the outer and concave on the inner edges of their proximal ends, more cylindrical at their distal ends, which reach beyond the tip of the rostrum. Each of these apophyses bears a thick hair; these hairs are nearly straight at first, but curve inward at their distal ends and generally cross; hairs and apophyses are closely set with villous processes. Pseudo-stigmata very projecting. Pseudo-stigmatic organs *very short and clavate*, the head not being so globular nor so distinctly marked off from the peduncle as in *N. horridus*; the heads are rough at

the ends. There are two curved longitudinal ridges springing from near the pseudo-stigmata, which look rather like rudimentary lamellæ. Interlamellar hairs extremely fine and small. The two first pairs of apodemata long. Sternum scarcely developed.

**Legs** of moderate length (the fourth pair scarcely reaching the hind margin), thick, rough, gradually diminishing in thickness, but each joint is slightly enlarged at the distal end. From the dorsal aspect the coxæ of the fourth pair are usually entirely, and those of the third pair almost entirely, hidden by the abdomen. Genuals and tibiæ of about equal length, the tarsi the longest joints. The legs are furnished with short, curved, almost hooked, serrated hairs, *each of which springs from a small but very distinct chitinous apophysis*; they are arranged about as follows: viz. two or three on the outside of each femur, and two on the inside of each of those of the first and second pairs; one on the outside of each genual, and one or two on the outside, and one on the inside of each tibia; one on the inside of each genual of the first and second pairs; four to six on each side of each tarsus; four or five on each coxa of the third pair, and one on the upper surface of each joint; the tarsi have the usual fine hairs. Claws tridactyle, almost homodactyle, but the central claw is the shortest.

**Abdomen** oblong, raised above the cephalothorax. Progaster very slightly convex. Hind margin with a small shallow concavity on each side; at the inner angle of which is a papilla, or wart: from the outer side, *not the end*, of this wart, a small chitinous apophysis stands out laterally bearing a rather spatulate, but not very large, curved hair, covered with villous processes. Between these apophyses the abdomen sinks down, and, for about the central third of its width, *becomes continuous with a large, median, flat projection from near the ventral surface*. This projection has sides sloping backward and inward, and rather over one-third in the centre of its hind margin is

slightly concave while the lateral parts of this margin are occupied by two very large, almost square projections or warts, which are directed backward, but, being slightly larger at their distal than their proximal ends, are nearest together distally; the transverse sections of these projections would be roundish; they are usually truncated, or somewhat hollow at the ends; and from near the middle of the truncated end springs a small apophysis bearing a small, very sharply curved, villous hair. Lateral margin straight in general outline, but with an irregularly undulated edge. The general level of the notogaster is flat, but the margin is decidedly raised, except posteriorly, the exterior edge being nearly the highest point. A more or less oblong space in the median line of the notogaster is bordered on all sides by an ill-defined, slightly-raised ridge, somewhat curved anteriorly and posteriorly, more straight laterally; but there is a slight constriction in the lateral ridges near which they are joined by a faint transverse ridge, and a diagonal ridge runs outward and backward from each of the posterior corners of the oblong. Three small chitinous apophyses, each bearing a very small, curved, villous hair, stand almost upright just outside each side of the oblong ridge, the first placed close to the anterior corner of the oblong, and the third in the before-named constriction; *the first and second of these apophyses are nearer together than the second and third.* A similar apophysis and hair are placed just behind the middle of the diagonal ridge. Outside the lateral parts of the oblong ridge the abdomen is concave, and then rises again, forming a broad, gradually raised margin; this bears a few irregular, more or less transverse ridges, and also (on each side of the body) three small chitinous apophyses, each carrying a short, curved, villous hair; *the apophyses do not project beyond the lateral margin of the body.* The pore of the expulsive vesicle is near the last of these apophyses, but a little nearer the median line. There are six similar apo-

physes and hairs by the progaster. Genital and anal plates close together, the former almost pentagonal, the latter longer and coming to a point posteriorly.

**Distribution.**—I think that this species is generally distributed, but it is not common. It has been recorded in Germany; possibly also in France and Italy.

**NOTHRUS BICARINATUS,\* Koch.** Pl. XLVII A, figs. 1—5.

- Nothrus bicarinatus*, Koch. Fasc. xxix, fig. 16.
- *ventricosus*, — Fasc. xxxviii, fig. 3.
- *rostratus*, — Fasc. xxix, fig. 19<sup>p</sup> with the lamellar hairs carrying dirt.
- *bicarinatus*, Nic. P. 456, pl. vii, fig. 3.
- — Can. e Fan., p. 26.
- — Haller. P. 306.
- — Berlese. Acari, &c. Ital., fasc. xvii, pl. iv.

Average length about .75 mm.

Average breadth about .35 mm.

Average length of legs (first and fourth pairs) about .40 mm.

Average length of legs (second and third pairs) about .30 mm.

G. Canestrini, in his ‘Prospetto dell’ Acarofauna Italiana,’ p. 31, gives this species as a synonym of *N. segnis*, which is a mistake, as Berlese has already pointed out.

**Colour** brown, of medium depth; the creature, however, usually covers itself with dirt to such an extent that the colour cannot be seen, nor indeed can the texture or markings.

**Texture** rough and dull. The whole creature is strewn with irregular, short, villous processes of the cuticle, which are easily rubbed off, but when *in situ* give a rough and granular effect.

**Cephalothorax** not so much hidden by the progaster as that of *N. horridus*; large, nearly as wide as the abdomen. Rostrum rather short and wide. Rostral

\* *Bis*, twice; *carina*, a keel.

hairs diverging. At the anterior edge of the dorso-vertex are two large chitinous apophyses, convex on their outer, slightly concave at their inner edges; thick at their proximal, and more cylindrical at their distal ends, which reach beyond the tip of the rostrum; each of these apophyses bears a large stout hair, thickly set with short villous processes; these hairs are straight at first, but curve inward at their distal ends, and generally cross. Pseudo-stigmata very projecting, not close to the progaster. Pseudo-stigmatic organs *very short*, but scarcely as short as those of *N. horridus*; with thin peduncles, varying a trifle in length in different specimens, and small, shortly pyriform, almost globular heads, rough at the ends. There are two slight longitudinal ridges nearer the median line than the pseudo-stigmata; these ridges may be almost straight or may be more loop-like. Interlamellar hairs very long and setiform; in perfect clean specimens they have fine whip-like ends which reach beyond the tip of the rostrum; *they spring from small but distinct chitinous apophyses* a little anterior to, and nearer the median line than, the pseudo-stigmata.

**Legs** of moderate length, the fourth pair about reaching, or very slightly passing, the hind margin; thick, rough, gradually diminishing in thickness, but each joint is slightly enlarged at the distal end. The legs are furnished with short, rough, curved, almost hooked hairs; each springs from an apophysis, but these apophyses are smaller and less distinct, and the hairs less broad than those of *N. horridus*; they are arranged about as follows:—Two or more on the outside of each femur, and two on the inside of each of those of the first and second pairs, one or two on the outside of each genual, and one on the inside of each of these joints of the first and second pairs, four or five on each side of each tarsus, four large and closely set on the outside of the third coxa, and one on the upper surface of each joint; the tarsi have the usual fine hairs. Claws tridactyle, almost homodactyle.

**Abdomen** oblong, rather longer and narrower in form than that of *N. horridus*. It is raised above the cephalothorax; progaster almost straight; *hind margin strongly concave, and without any median projection from a lower level*. At each corner of the hind margin is a chitinous, cylindrical apophysis bearing a large, rough, curved hair covered with villous processes; a pair of similar, but much smaller, hairs project from the ventral surface near the median line, but are not always visible from above. The posterior corners of the abdomen are, as it were, cut away at an angle, the anterior end of the sloping edge bears an apophysis and a hair similar to those at the posterior end, but smaller; the space between these two apophyses, which in *N. horridus* forms part of the hind margin, appears in the present species to belong rather to the lateral margin, which is straight in general outline, but with the edge broken into two slight concavities, and these again often irregularly indented. The general level of the notogaster is flat, but the margin is considerably raised, and the outer edge is the highest part. A long loop-shaped ridge, or two longitudinal ridges joined at the ends by transverse curved ridges, but without any break or sharp angle, enclose a median, longitudinal irregular space, which is much wider posteriorly than anteriorly; from the widest part of this, *i. e.* where the longitudinal ridges join the posterior transverse ridge, an oblique ridge runs out to the truncated angle. The raised margin has numerous, irregular, more or less transverse, raised ridges. On the notogaster, close outside, but not on, the longitudinal median ridge on each side, are four small, curved, rough, pointed hairs, which spring from apophyses, but these apophyses are much smaller than those of *N. horridus*, and stand erect, instead of horizontally as in that species; the first is at the anterior edge of the ridge, the second and third are much nearer together than the first and second; this trifling character appears very constant, and affords a

convenient means of distinguishing the species from *N. horridus*. The raised lateral margin on each side bears three similar hairs and apophyses, the latter are very small and do not project beyond the lateral margin. The pore of the expulsive vesicle is near the last of these apophyses. There are six similar hairs by the proctiger. Genital and anal plates close together, the former the wider and somewhat pentagonal; the latter longer and coming to a point posteriorly.

**Distribution.**—Common and generally distributed; it may be obtained in abundance by beating trees in spring, especially oaks. The species has been recorded in Germany, France, and Italy.

NOTHRUS SEGNIS\* (*Herm.*). Pl. XLVIII, figs. 1—6.

*Notaspis segnis*, Herm. P. 94, pl. iv, fig. 8.

*Nothrus* — Koch. Heft 31, fig. 1.

— — Haller. P. 306.

— — Can. e. Fan., p. 27.

— — Berlese. Acari, &c. Ital., fasc. xvii, fig. 2, and Notes, fasc. iii, p. 8.

— — G. Canestrini. Prospetto d. Acarofaun. Ital., p. 31.

*Oribata* — Gervais. T. iii, p. 254.

*Nothrus furcatus*, Koch. Heft 30, fig. 3. Nymph.

— *biurus*, — Heft 30, fig. 2. Nymph?

— — Can. e. Fan., p. 27. Nymph.

Average length about .85 mm.

Average breadth about .32 mm.

Average length of legs (first pair) about .45 mm.

Average length of legs (second pair) about .33 mm.

Average length of legs (third pair) about .38 mm.

Average length of legs (fourth pair) about .48 mm.

This singular creature may be known by the great length of the abdomen in proportion to its width, and by the strange way in which it carries the cast skins of the two conical tail-like processes which terminate the abdomen of the nymph.

\* *Segnis*, lazy.

**Colour** yellow brown; usually of medium depth. The animal is often partly concealed, and the hairs, &c., are matted up by dirt, but it is not as dirty as *N. horridus*, &c.

**Texture** dull, the whole surface thickly covered with raised dots.

**Cephalothorax** flat, short, broadly conical; deeply indented for the insertion of the first pair of legs; the margins of this indentation are sharply raised, and project beyond the general outline of the body. Rostrum very short, slightly truncated; rostral hairs straight and diverging. Behind the rostrum is a strong convex ridge, higher in level than the rostrum, and on or immediately behind this are two very large apophyses, which project considerably beyond the tip of the rostrum; these apophyses are nearly straight, and diminish gradually but slightly towards the tip, but at the proximal ends they are prolonged transversely from the inner side; and there is a thin, narrow blade along the outer edge. From the end of each of these apophyses springs a large, curved, or rather hooked, thick spine, which, when clean enough, is seen to be fringed with long, flexible, villous processes on its outer edge. The spines from the two sides cross, and they are often matted up by dirt into one mass, with the interlamellar hairs; indeed, a great part of the above detail can only be seen when the creature has been artificially cleaned, either with sodium hydrate or in some other manner. There are two small ridges like rudimentary lamellæ. Pseudo-stigmata very projecting, and far apart. Pseudo-stigmatic organs very short, with thin peduncles, and small, shortly pyriform heads. Interlamellar hairs very long, and set on both sides with villous processes like those above described; they spring from apophyses.

**Legs** of moderate length, the fourth pair does not reach the hind margin. They are broad and flat and diminish gradually in thickness, the genua and tibiæ are of about equal length, and the femora and tarsi of

about equal length. All the legs are bordered by strong, hooked spines arranged somewhat as follows, viz. four on the outside of the third coxa, four to six on the outside, and two to four on the inside of each femur; one on each side of each genual; two on each side of each tibia, and four on each side of each tarsus. There are numerous other strong hairs and spines on the tarsi. Claws *tridactyle*, middle claw rather the smallest.

**Abdomen** oblong, very long and narrow; between three and four times as long as the cephalothorax. Progaster almost straight, very slightly convex, considerably raised above the cephalothorax; lateral margins almost straight, very slightly convex. The postero-lateral corners of the abdomen are sharp, almost pointed, and are directed slightly outward (fig. 6, *b*). The hind margin of this projection is straight or indented, forming a more or less square projecting corner to the abdomen; on the inner side of this is an apophysis (*c*) directed backward and bearing a large, thick, curved hair with short, villous processes on each side (*d*). Between these apophyses the hind margin is concave. The whole of this structure of the hind margin and corners is usually hidden by the posterior portion of the nymphal skin (*i, p, e*) which persists; it covers a narrow strip of the hind margin, but projects beyond it in a broad, semi-transparent white band, with a long, irregularly conical tail at each corner (*p*), which contains the real corner of the abdomen and its appendages, as it were, in a bag. This bag bears a small apophysis (*g*) and a large curved hair (*h*) at its point. There is a slightly depressed space in the centre of the abdomen bordered all round by a raised ridge; this space has rounded ends and rather curved sides anteriorly, where it is widest; but is more parallel-sided and narrower further back. Outside the ridge the notogaster is somewhat concave, and then rises again to the lateral and anterior margins; these raised edges have some vague

transverse wrinkles. There are about four small, thick hairs on each lateral margin and four on the progaster; none of these hairs arise from apophyses or project beyond the body (they are omitted in the Plate). Genital and anal plates close together, the latter not reaching anywhere near the end of the abdomen, the former pentagonal, the latter diminishing to a point.

*Nymph.*

This nymph varies considerably with age.

**Colour** of rostrum and legs chitinous-brown, not very dark; abdomen and hinder part of cephalothorax yellowish-white.

**Texture** slightly rough, dull, and entirely without polish.

**Shape**.—Much the same as that of the adult, but the abdomen rather wider in the middle in proportion to its length, and bifurcate posteriorly.

**Cephalothorax**.—Rostrum broadly conical, with curved sides; behind the rostrum there is a very slight gradual constriction, and then the cephalothorax expands to nearly the width of the progaster; the outline of the hinder part is rounded. There are not any markings on the cephalothorax, but it is rough and granular. Rostral hairs as in the adult, and there are a pair of hairs corresponding to the lamellar hairs, large, thick, and curved inward. In full-grown nymphs these last-named hairs spring from apophyses. Pseudo-stigmatic organs rod-like, of moderate length. The cephalothorax is somewhat depressed where it abuts on the progaster.

**Legs** inserted very near together, gradually diminished in thickness towards the distal ends. They are short, the fourth pair not nearly reaching the hind margin. They are bordered by curved hairs as in the adult, but less strong.

**Abdomen** raised along the line of the progaster, and

with a broad raised band along each side ; the median portion of the notogaster being depressed. The progaster is almost straight, the lateral margins are not so parallel as in the adult, the central portion of the abdomen being decidedly the widest, but still the departure from the parallelogram is not very great. The abdomen is strongly bifurcate posteriorly, ending in two long conical tails which form about one-fourth of the length of the entire abdomen ; each tail ends in a long, slightly-spatulate hair curved inward. These tails are directed backward and slightly upward, so that their distal ends are the highest portions of the creature ; just inside them, on the hind margin, are two smaller hairs curving outward, there are six thick hairs on the progaster springing from papillæ in fully-grown specimens, and a few hairs on the lateral margin (these hairs are not shown in the drawing).

**Distribution.**—The adult and nymph are chiefly found at the roots of mosses (on the ground). I have found them more on the Yorkshire and Cumberland hills than anywhere else, but have had a few from Epping Forest, Axe Edge (Staffordshire), and elsewhere. The species is not very common ; it has been recorded in Switzerland, Germany, and Italy, and I have found it in Norway.

NOTHRUS THELEPROCTUS\* (*Herm.*). Pl. XLV, figs. 1—9 ;  
 Pl. A, fig. 10 ; Pl. B, figs. 3, 4, 7, 10, 12, 14, 16, 20,  
 22, 24, 26 ; Pl. C, figs. 8, 9, 10 ; Pl. D, figs. 1, 11,  
 12, 15 ; Pl. E, fig. 3 ;  
 Pl. F, figs. 4, 8, 9, 14.

*Notaspis theleproctus*, *Herm.* P. 91, pl. vii, fig. 5.

*Liodes* — *Heyden.* Isis, 1828.

*Nothrus* — *Koch.* Heft 29, fig. 10.

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\* Θηλή, a teat ; Πρωκτός, anus.

*Nothrus farinosus*, Koch. Heft 29, fig. 8, with one cast skin only?

— *theleproctes*, Haller. P. 306.

— *Doderleinii*, Berl. Acari, &c. Ital., fasc. iii, tav. 2.

*Liodes* — — — Ibid., Notes, fasc. iii (1885).

*Nothrus circumvallatus*, Haupt. Käfermilben um Bamberg, p. 22?

(The *Nothrus (Liodes) theleproctus* of Berlese is a different species.)

Average length about 1·1 mm.

Average breadth about ·65 mm.

Average length of legs (first pair) about ·45 mm.

Average length of legs (second pair) about ·37 mm.

Average length of legs (third pair) about ·46 mm.

Average length of legs (fourth pair) about ·58 mm.

A large species, easily distinguished by its carrying the notogastral cast skins, and by the peculiar shape of the posterior part of the abdomen.

**Colour.**—Very dark chestnut-brown; the whole abdomen is, however, hidden by the cast skins, which are usually mouse-colour.

**Texture** rough, and dull in every part. There is not an even or unbroken line in the whole creature.

**Cephalothorax** very rough and broad, nearly as broad as the progaster, from which it is marked off by a deepish sulcation. The whole surface is covered by irregular vermiciform ridges. The cephalothorax is thick and arched, with two broad raised lobes covering the postero-median portion, and leaving a longitudinal median depression between them. Rostrum broad, blunt, with a trifid outline if seen when raised, and a rounded outline if seen when lowered. Rostral hairs short and curved. Pseudo-stigmata large and projecting, placed dorsally at the posterior angles. Pseudo-stigmatic organs of moderate length, thick, slightly clavate or thickened toward the distal end, directed outward and backward. Interlamellar hairs rudimentary.

**Legs** thick and flattened, of moderate length, hind pair scarcely reaching the posterior end of the abdomen, they are extremely rough. Femora broad and

longish. Tarsi short and round. There is a short, thick, curved, spatulate hair on each side of each of the three central joints of the two front pairs of legs, and a second similar hair on the outside of each femur, and similar hairs on the outer edges of the two hind pairs of legs. The tactile hairs are small. Tarsi with fine hairs as usual. Claws large and distinct, tridactyle.

**Abdomen** entirely hidden by the cast notogastral skins of the larva and nymph, which are nearly, but not quite flat. The larval skin is somewhat raised and arched. The nymphal skins are flatter, but turn down at the edges and have a tendency to turn upward at the posterior end. Progaster of each skin almost straight, then the skin increases gradually with a curved (convex) lateral margin for nearly two-thirds of its length, then finally it narrows, at first with a strongly convex margin, but at the hinder end it is drawn out into a long rounded point, the sides of which are concave, and which bears two spatulate hairs at the tip. The larval skin is bordered by an irregular raised fold or roll, formed by the shrinking of the skin after it is cast; inside this there are three or four irregular transverse ridges on the anterior portion of the skin, and behind them is a large, raised, rounded, inversely bell-shaped portion. This skin is rough, with irregular short rugosities. The nymphal skins are coarsely areolated, the areolations shallow, and largest on the most mature skins. The skins are not quite centrally placed, each a little more backward in position than the earlier skin, so that a wider portion of each nymphal skin is shown anteriorly than posteriorly, but yet the posterior edges do not overlap. There is a nearly straight, transverse, linear ridge a little behind the progaster of each nymphal skin; this ridge runs backwards at the ends, and fades into the lateral outline of the skin. Ventral surface rough. Genital and anal plates large, close together; the former shortly and widely pyriform, *i.e.* somewhat widest posteriorly, the latter pentagonal.

*Nymph and Larva.*

These so closely resemble the perfect creature that it is not necessary to describe them separately. The principal differences are of course the monodactyle claws, the smaller size, the lighter colour, which is somewhat greenish in the nymph, but the very young larva is often a darkish red-brown, which soon becomes lighter, and that the larva does not carry any cast skin, while the nymph carries a varying number, from one to three, according to size.

**Distribution.**—The species is common and generally distributed—it is usually found in moss, most frequently that growing on trees.

Berlese, in his ‘Acari Miriapodi e Scorpioni Italiani’ (fasc. iii and Notes published separately in 1885), appears to have confused two species. He treats this as a new species, calling it after Prof. Petro Doderlein, and transfers the name and all the bibliography of this species to another species which appears to be the “*Nothrus scaliger*” of Koch; which Berlese gives as a synonym. Haller, in his ‘Milbenfauna Württembergs,’ treats *scaliger* as probably a nymph of *theleproctus*. I should not think that this would be correct, but I have not found *scaliger* in England.

*NOTHRUS GLABER,\* sp. nov.*

Average length about .60 mm.

Average breadth about .32 mm.

Average length of legs (first and second pairs) about .22 mm.

Average length of legs (third pair) about .24 mm.

Average length of legs (fourth pair) about .28 mm.

This species is very like *N. tardus*, from which it

\* *Glaber*, smooth,

may be known by its much larger size, smooth (not reticulated) cuticle, more pointed rostrum, &c.

**Colour** yellow-brown, of medium depth of tint.

**Texture** smooth, but not shining, without any reticulation.

**Cephalothorax** rather long, much narrower than the abdomen. Rostrum more elongated than that of *N. tardus*, rather narrow, but the actual tip is rounded; rostral hairs rather long and set far back. The chelæ of the mandibles are fine, long, and straightish, meeting only near the ends, and but slightly dentate. No exterior pseudo-stigmata of the ordinary tubular projecting type are visible; there is, however, a long setiform hair on each side, as in *N. tardus* (see that species). Apodemata joined to the sternum, which, however, is broken between the second and third pairs of legs.

**Legs** short, not very thick; the first pair pass the tip of the rostrum by about half the length of the tarsi; the fourth pair reach beyond the middle of the anal plates; the third and fourth pairs are set a good deal under the abdomen, as in *N. tardus*. Tibiae not longer than the genua; tarsi the longest joints. They bear two or three almost spike-like hairs in the upper median line and a few true spikes in the median line below (but they do not bear the tooth-like processes of *N. monodactylus*). The other joints have a few setiform hairs. *Claws tridactyle*, central claw much the shortest.

**Abdomen** flat, shield-shaped. Progaster almost straight *without projecting corners*; hind margin almost pointed. There are two longitudinal rows of about three setiform hairs each on the notogaster. Genital and anal plates close together, the former considerably broader than the latter. At the anterior inner corners of the genital plates, and within the abdomen, are two paired processes for the attachment of muscles, which processes are remarkably large and of dark chitin, so that when the specimens have been rendered translucent and mounted in balsam, these processes become

conspicuous. Some specimens have a few slight longitudinal wrinkles on the notogaster.

### *Nymph.*

The nymph is so like the adult that it is not necessary to describe it elaborately ; the principal differences are the softer and lighter cuticle and the monodactyle claws of the nymph, and that its abdomen has a few broad, irregular, more or less transverse wrinkles, which give it a broken outline.

**Distribution.**—I have a specimen or two of this species caught at Epping Forest in 1879. Mr. E. Bostock has found one or two in the Midland Counties, and I received some goods packed in dry sphagnum a short time since, and on examining the sphagnum found that it contained numerous dead specimens of this species. I was not able to ascertain where the sphagnum came from. On a visit to the New Forest in April, 1887, however, I found the species fairly common in one or two of the pools, living in sphagnum under water ; it appeared to be either a truly aquatic, or an amphibious species.

### NOTHRUS TARDUS,\* sp. nov. Pl. XLVII, fig. 14.

Average length about ·36 mm.

Average breadth about ·20 mm.

Average length of legs (first pair) about ·10 mm.

Average length of legs (second pair) about ·08 mm.

Average length of legs (third pair) about ·10 mm.

Average length of legs (fourth pair) about ·13 mm.

This is a small species very like *N. monodactylus*, from which it may be known by its tridactyle claw, different tarsi, larger size, &c.

**Colour** light yellow-brown.

**Texture** very finely and almost evenly, reticulated

\* *Tardus*, slow.

all over; reticulations about 300 to 350 to the millimètre, pits about half as wide again as the ridges.

**Cephalothorax** of moderate length, narrower, but not conspicuously narrower than the abdomen. Rostrum rather broad, rounded. Rostral hairs rather long and far apart. No exterior pseudo-stigmata of the ordinary tubular projecting type are visible, there is, however, undoubtedly a long setiform hair on each side; it is very doubtful whether this is to be regarded as the homologue of the pseudo-stigmatic organ or of the interlamellar hair; the position favours the former, the structure, the latter view. A precisely similar arrangement is found in *N. monodactylus*, and *N. glaber*; the last-named species appears to be aquatic, and the other appears also to be sometimes found in *sphagnum*; it is worth remembering that the external pseudo-stigmata and pseudo-stigmatic organs are sometimes absent, or beyond my power to detect, in aquatic or amphibious species. The apodemata are joined to the sternum, except the third, in which case those from the two sides join, the sternum ceasing in that part of the body and commencing again further back.

**Legs** short, rather thick; the first pair passing the tip of the rostrum; the fourth pair reaching to about the middle of the anal plates. The third and fourth pairs are set under the abdomen, but not so much so as in *N. monodactylus*. The tibiae are not longer than the genua; tarsi the longest joints; they bear some thick, not very long, setiform hairs in the upper median line, varying in number on the different legs, and there are a few hairs of the same class on almost every joint; but the thick, tooth-like spikes of the tarsus of *N. monodactylus* are not found. *Claws tridactyle*; central claw the shortest.

**Abdomen** flat in general level; *shield-shaped*, pro-gaster nearly straight, but the antero-lateral corners of the abdomen form small rounded projections directed forwards; each bearing a large setiform hair directed outward; hind margin nearly pointed. The central

and marginal portions of the notogaster are slightly raised and rounded, leaving a shallow depressed line between them (this does not apply to the progaster). There are two longitudinal rows of about three setiform hairs each on the notogaster; the pore of the expulsive vesicle is near the posterior of these. Genital and anal plates close together, the former somewhat broader than the latter, which come almost to a point posteriorly.

*Nymph.*

The nymph is so like the adult that it is not necessary to describe it elaborately; the differences are the softer cuticle without reticulations, the monodactyle claw, and that the abdomen has a number of broad, irregular, more or less transverse wrinkles, which give it an irregular outline.

**Distribution.**—I have only found a very few specimens of this species at the Land's End, Cornwall, on lichen growing on the granite rocks; it is, however, small and easily missed.

NOTHRUS MONODACTYLUS,\* sp. nov. Pl. XLV, figs. 10—14.

Average length about .29 mm.

Average breadth about .19 mm.

Average length of legs (first and fourth pairs) about .1 mm.

Average length of legs (second and third pairs) about .08 mm.

This very small species may be known by the shield-shaped abdomen, short legs, the two hind pairs of

\* Μόνος, alone; δάκτυλος, a finger.

which are usually concealed beneath the abdomen, and by the monodactyle claws.

**Colour** light whitey-brown.

**Texture** dull, but not rough, not very highly chitinized.

**Cephalothorax** long, considerably narrower than the abdomen. Rostrum rather broad, round-pointed in the centre, suddenly bowed outward at the sides. Rostral hairs rather long and far apart. *No pseudo-stigmata of the ordinary type* are visible, there is, however, undoubtedly a long setiform hair on each side about where the pseudo-stigmata would be likely to be placed; whether it is to be regarded as the representative of the pseudo-stigmatic organ or of the inter-lamellar hair it is difficult to say. This hair is accidentally omitted in the figures, but a similar hair is shown in the figure of *N. tardus*, a species greatly resembling the present one, but *larger* and with tridactyle claws: the hair is stronger in *N. tardus*. The apodemata are joined to the sternum, except the third; in which case the apodemata from the two sides join, the sternum ceasing in that part of the body and commencing again farther back (fig. 11).

**Legs** very short and thick, the first pair scarcely passing the point of the rostrum, *the fourth pair reaching only a little beyond the commencement of the anal plates*. The third and fourth pairs are set very much under the abdomen, and unless artificially extended are usually wholly hidden from the dorsal aspect. The tibiae are scarcely if at all longer than the genua. The tarsi are thick and blunt-ended; each has a short, but very thick and strong, curved, rather tooth-like spike of clear chitin in the median line a little before the claw, and a similar but smaller spike at the side near the distal end; there is also a curious, squarish, tab-like process on each side of the claw. The third and fourth tarsi, particularly the latter, have quite a bunch of small thick spikes or teeth at the distal end.

Claws *monodactyle*, thick, somewhat less curved than usual.

**Abdomen** flat, *shield-shaped*, without markings; progaster nearly straight; hind margin not quite pointed; there is a sparse line of rather short setiform hairs round the lateral and hind margins. Genital and anal plates close together, the former broader than the latter, which reach the hind margin.

**Distribution.**—I have only two or three specimens, from moss on the ground; Mr. Bostock has one or two from moss at Cannock Chase, and found others in some dried sphagnum sent to him, and which was supposed to have come from abroad. I believe the species to be unrecorded.

#### GENUS—HYPOTHONIUS,\* Koch.

*Apterogasterinae* with cephalothorax anchylosed to abdomen; notogaster more or less flat; abdomen distinctly segmented, often with lateral blades.

This genus was instituted by Koch, who knew of two species, *H. rufulus* and *H. pallidulus*. Nicolet asserted that these two were nymphs, and that the genus was entirely founded on an immature type. In this Nicolet was in error, but it was natural enough that he should have made the mistake if he did not see the adult female with eggs; for the imperfect chitination of the cuticle, the bright colouring, and the monodactyle claws of the creatures which compose this genus, make them look very like nymphs; and two of Koch's other genera, viz. *Celano* and *Murcia*, are really composed of nymphs. It is less easy to understand why Nicolet specially selected *H. rufulus* as being the nymph of *Leiosoma ovatum*. Haller pointed out some

\* Υπόθονος, beneath; χθόνιος, terrestrial.

time since that the creatures were adult, frequently containing ripe eggs; this fact is easily observable, as the eggs are very large, and moreover it is quite possible to rear them.

It is stated in the definition of the genus that the cephalothorax is ankylosed to the abdomen, and this is true, there is not any distinct joint between the two as in *Hoplophora*; but the result of the imperfect chitinization and consequent flexibility of the cuticle, combined with the comparative activity of the members of this genus, is that the cephalothorax is capable of more movement upon the abdomen than is usual in the adults of the *Oribatidæ*, although it is frequent amongst the immature stages.

The leading character of the genus, by which it may be at once distinguished from all others at present known, is the segmented abdomen of the adults; this again may be seen in some young larvæ.

The **Rostrum** is most commonly long and pointed (*H. pallidulus*, &c.); it may be blunter, *H. brevis*. The rostral hairs vary much, sometimes fine (*H. rufulus*), sometimes serrated (*H. brevis*), while in *H. lanatus* they attain a remarkable development, and resemble bunches of white wool in general appearance, although not in actual structure.

The **Labium** is usually short and broad, covering less than half the mouth-opening, but it may be prolonged by paired organs answering to the ligula in insects (*H. pallidulus*); this is common in other genera of *Oribatidæ*.

The **Palpi** are long and usually almost cylindrical; nearly their whole length can generally be seen from the dorsal aspect, as they are not concealed within the mouth-cavity. They are slender in the typical species (Pl. XLIX, fig. 10), more robust in *H. lanatus* (fig. 17). The fifth joint is generally the longest.

The **Maxillæ** are generally weak, slightly chitinized, and hardly dentate, they scarcely have the appearance of crushing organs.

The **Mandibles** vary considerably ; in *H. rufulus* and *H. pallidulus* they are long and narrow, with closely-set fine teeth (fig. 9) ; in *H. lanatus* they are very exceptional, being short and broad, the teeth so deeply cut as to be almost comb-like ; and the fixed arm of the chela having a narrowed neck ; while above it stands a sort of reduplication of the part, which is not known to me in any other species.

The **Pseudo-stigmata** are usually dorsal and but slightly projecting. The pseudo-stigmatic organs in the few species known appear divided into two types ; one long, sweeping, doubly curved, and sparsely but regularly and strongly pectinated on one side only (figs. 3, 11) ; the other with short peduncles and more or less fusiform heads, densely but irregularly covered with short hairs or villous processes ; the fusiform effect of these organs is greatly due to the accumulation of white flocculent matter on these short hairs along the distal part of the organ (figs. 14, 15).

The **Lamellæ** are absent, but the lamellar hairs generally persist.

The **Tectopedia** are not developed.

The **Apodemata** are not joined to the sternum, and the latter organ is broken and imperfectly developed. The apodemata from the two sides between the second and third pairs of legs occasionally join, as in some *Nothrus*.

The **Legs** are generally of moderate length and diminish more or less regularly from the proximal to the distal ends ; the tarsi are ordinarily the longest joints. The claws are monodactyle in all known species.

The **Abdomen** is generally more or less flat or moderately arched, and somewhat shield-shaped or diamond-shaped ; it is always distinctly divided into segments, two to four in known species, by transverse, straight, or curved cuts, or infoldings of the cuticle. These segments have a slight telescopic motion in *H. lanatus* which enables it to erect the spines on its

back. The lateral edges of the abdomen are provided with thin blades in most species, which may be large and conspicuous as in *H. rufulus*, where they are formed by the depression of the dorsal surface (fig. 6), less conspicuous as in *H. pallidulus*, where they are formed by the thinning of the ventral surface, or almost obsolete as in *H. lanatus*, where they are formed in the same way and confined to the anterior parts of the abdomen. These blades have but little analogy to the pteromorphæ of the *Pterogasterinæ*.

The **Genital and Anal Plates** are much of the same type as is most common in *Nothrus*, viz. large and close together, the former being the broader; in *Hypocthonius* the genital plates are sometimes far the larger, so as to admit of the passage of the egg, which is of remarkable size.

The **Ventral Plate** is small and more or less triangular, the dorsal plate being much sufflexed on to the ventral side.

I have not had much opportunity of examining the internal anatomy of this genus, but I may mention that in the species known to me the ovipositor seems short and thick, and only one egg appears to ripen at a time, but this ovum is remarkably large.

The **Hairs** attain a singular development in some species, the long serrated spines on the notogaster of *H. lanatus*, and the woolly hairs on other parts of its body, are the best examples; but the hairs on the notogaster of *H. rufulus* are also somewhat exceptional.

The **Nymphs** of this genus usually resemble the adults but are lighter in colour.

The **Habitats** appear to be chiefly moss growing on the ground in damp woods, comparatively dry sphagnum, not that in water, and occasionally old cellars, &c.

*Table to assist in the identification of the British species  
of Hypothonius.*

Abdomen of two almost equal segments . . . . . RUFULUS.

|                                                                                                        |                                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Abdomen of three segments, the central narrow and band-like, the anterior and posterior almost equal . | Pseudo-stigmatic organs long, filiform, curved, and strongly and regularly pectinated . . . . . PALLIDULUS.<br>Pseudo-stigmatic organs short, with thin peduncles and fuscous hairy heads . . . . . BREVIS. |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Abdomen of four segments, the two central narrow and band-like, the anterior and posterior almost equal . . . LANATUS.

HYPOTHONIUS RUFULUS,\* Koch. Pl. XLIX, figs. 6—13.

*Type species..*

*Hypothonius rufulus*, Koch. Heft 3, fig. 19.  
*Leiosoma ovata* (Nymph), Nic. P. 395, pl. v, fig. 5.

Average length about ·58 mm.

Average breadth about ·40 mm.

Average length of legs (first pair) about ·29 mm.

Average length of legs (second and third pairs) about ·25 mm.

Average length of legs (fourth pair) about ·35 mm.

This species was originally described by Koch as an adult creature. Nicolet subsequently not only asserted it to be a nymph, but even stated of what species it was the nymph (or larva as he calls it), viz. *Leiosoma ovatum* (*ovata* in Nic.). In this he is entirely in error. Haller some time ago pointed out that this is an adult creature, and I have frequently found specimens containing ripe eggs, and have bred larvæ from them. Moreover, the nymph of *Leiosoma ovatum* is totally different (see this book, vol. i, p. 278).

**Colour** uniform all over the creature ; but it varies

\* *Rufulus*, reddish.

in different specimens, and in the same specimen at different ages ; it is most commonly that of very old, tawny, port wine, but hardly as dark ; sometimes the red, sometimes the yellow, is predominant.

**Texture** smooth and slightly polished.

**Cephalothorax** about one-third of the entire length, much narrower than the abdomen ; almost conical : it has considerable movement upon the abdomen. Ros-trum pointed ; behind it the cephalothorax becomes slightly concave-sided ; the base widens suddenly, and then narrows so as to form a well-marked constriction between it and the abdomen. The centre of the hinder part of the dorsum of the cephalothorax is raised, and there is a constriction in front of this elevation. Rostral hairs fine, almost straight. Palpi long and thin ; they show very conspicuously (almost their whole length) from the dorsal aspect. Lamellar hairs long, upright, setiform. Pseudo-stigmata dorsal. Pseudo-stigmatic organs very long, almost filiform, but eventually coming to a point, doubly-curved, some-what recumbent, pectinated along the greater part of the upper anterior edge only ; the teeth or hairs forming the pectination are long and pointed, sparsely but regularly placed. Interlamellar hairs long, filiform, not coming to a point. Apodemata not joined to the sternum. The sternum imperfect.

**Legs** of moderate length, the fourth pair when stretched out substantially passing the hind margin ; the third and fourth pairs, however, are usually held much bowed (fig. 13), and are set under the abdomen. The legs gradually diminish in thickness from the proximal to the distal ends ; femora about as long as the next two joints together ; genua as long as the tibiæ ; tarsi the longest joints ; they are thickly clothed with long fine hairs, almost all the other joints are provided with setiform hairs which are arranged in whorls on the two front pairs of legs. The tactile hairs are long and fine. Claws monodactyle.

**Abdomen** more or less shield-shaped, distinctly

divided into *two segments* by a straight, transverse cut a little anterior to the middle. The median portion, which contains all the organs, and is of substantial thickness, is practically a continuation of the conical form of the cephalothorax, but the sides for the greater part of the length are broad, thin, semi-transparent expansions or blades. These expansions commence with rounded shoulders close to the cephalothorax, have convex and slightly undulated exterior margins, and terminate at the broadest part of the median cone about a quarter of the distance from the hind margin. The solid median portion is divided by four or five transverse constrictions. Progaster rather concave; the hind margin strongly undulated, with a central point, the median solid part of the notogaster is arched, the lateral expansions depressed, almost to the ventral level. There are four longitudinal rows of very long, curved, almost filiform hairs on the notogaster, two at the outer edge of the anterior division of the lateral expansion on each side, and a few smaller hairs round the hind margin. The dorsal plate is very greatly sufflexed on to the ventral surface; the ventral plate is small and inversely conical. Genital and anal plates of moderate size, close together, and set far back; the former are short, oblong, rounded anteriorly, the latter more lengthened, and reaching the hind margin.

### *Nymph.*

Is practically similar to the adult, but is very much paler in colour.

### *Egg.*

As it has been doubted whether this creature is mature I have thought it best to figure the egg, which may be easily seen within the body of the female, easily dissected out and examined, and may also be

obtained after oviposition and bred. There is not anything special about it otherwise to call for observation ; it is rather transparent and slightly chitinized. In the specimen figured (fig. 8) segmentation is considerably advanced.

**Distribution.**—The creature lives in moss on the ground on fresh green banks, chiefly in spring ; it is, I think, generally distributed, but is not common. It has been recorded in Germany, France, and Switzerland.

HYPOTHONIUS PALLIDULUS,\* *Koch.* Pl. XLIX, figs. 1—5.

*Hypothonius pallidulus*, Koch. Heft 3, fig. 20.

Average length about .36 mm.

Average breadth about .19 mm.

Average length of legs (first pair) about .13 mm.

Average length of legs (second and third pairs) about .11 mm.

Average length of legs (fourth pair) about .15 mm.

This creature is remarkably rapid and mobile for one of the *Oribatidæ*; the cephalothorax has a decided movement upon the abdomen, and even the rostral part of the cephalothorax itself seems more or less flexible.

**Colour** light yellow-brown, running into red-brown at the edges of the abdomen, and of the various joints of the legs ; the same colour is often found on a central patch near the progaster.

**Texture** slightly polished.

**Cephalothorax** narrower than the abdomen. Rostrum almost pointed, rather long and narrow ; the hinder part of the cephalothorax sub-globose. Rostral hairs very fine. Palpi long and thin ; they show very

\* *Pallidulus*, somewhat pale.

conspicuously (almost their whole length) from the dorsal aspect. Pseudo-stigmata dorsal. Pseudo-stigmatic organs very long, almost filiform, but eventually coming to a point; doubly curved, somewhat recumbent; pectinated along the greater part of the upper anterior edge only; the pectinations are long and pointed, sparsely but regularly placed. I have not been able to observe any lamellar or interlamellar hairs. Apodemata not joined to the sternum. Sternum imperfect.

**Legs** short, not nearly reaching the hind apex of the abdomen; the joints of the first two pairs somewhat rounded. The two hind pairs are set under the body upon a central elevated portion of the ventral surface. The tarsi, although longer than the tibiæ, are not nearly so long in proportion as in *H. rufulus*. Tactile hairs on the first pair of legs very long. Tarsi clothed with fine hairs. There is a whorl of short curved hairs on most of the other joints, except the coxæ. Claws monodactyle.

**Abdomen** almost diamond-shaped, the posterior half of the diamond being the shorter, but it is truncated anteriorly; distinctly divided into three segments by two curved transverse cuts. Of these segments the anterior and posterior are large, but the central segment is a mere band, convex anteriorly. There are four longitudinal rows of short, thick, white hairs on the notogaster; a short spine on the antero-lateral angle pointing outward; and about five curved hairs, also short, along each side. The dorsal plate is very greatly sufflexed on to the ventral surface, the ventral plate small and inversely conical. The genital and anal plates are close together; the former very large, apparently to allow of the passage of the disproportionately large egg of this species; the anal plates are much smaller and shorter, and reach the hind margin.

*Nymph.*

Is practically similar to the adult, but is much paler in colour.

**Distribution.**—I have found this species at the roots of ground mosses in Epping Forest; I have not found it often. It has been recorded in Germany.

HYPOTHONIUS BREVIS,\* sp. nov. Plate XLIX, fig. 14.

Average length about .18 mm.

Average breadth about .11 mm.

Average length of legs (first pair) about .08 mm.

Average length of legs (second and third pairs) about .07 mm.

Average length of legs (fourth pair) about .09 mm.

An extremely minute, but thick-set species; the body is less mobile than those of other members of the genus.

**Colour** almost yellow, but shading off from yellow-brown to nearly gamboge-yellow, the variation being chiefly dependent on light and shadow.

**Texture** dull and rather rough, but not distinctly pitted as *H. lanatus* is.

**Shape** approaching a short oblong, much less pointed anteriorly and posteriorly than other British species of the genus, except *H. lanatus*.

**Cephalothorax** larger in proportion to the total size than is usual in *Hypothonius*. Rostrum rounded; rostral hairs large and slightly serrated. Palpi long, they show distinctly for almost their whole length from the dorsal aspect. Pseudo-stigmata dorsal. Pseudo-stigmatic organs shortish, white, directed nearly horizontally backward and slightly outward,

\* *Brevis*, short.

with moderately slender peduncles, and fusiform heads covered with fine hairs. Interlamellar hairs almost spines, white.

**Legs** short, fourth pair scarcely passing the hind margin; of nearly even thickness throughout, except the tarsi, but the genuals and tibiæ have a tendency to a moniliform appearance. Tactile hairs on the first pair of legs very long and flexible. A short, thick, curved hair on each side of each genual and tibia of the first two pairs of legs; a similar hair on the outside of each of the femora of the same legs, and a straighter hair, otherwise similar, on each of the three central joints of the two hind pairs of legs. Hairs on the tarsi shorter than usual, and there are a few other hairs. Claws monodactyle.

**Abdomen** slightly arched, truncated anteriorly, more rounded posteriorly, almost parallel-sided. It is distinctly divided into *three segments*, of which the central is far the narrowest (from front to back). The divisions curve forward. There are two longitudinal rows of thick white hairs on the notogaster, and a series round the periphery, a little way within the edge, of which that on the antero-lateral angle stands out conspicuously; there is also a hair on each side of the first segment, near the posterior edge, and between the peripheral and longitudinal rows, and a few round the hind margin. Genital and anal plates large and close together, the former much the wider, and as long as the latter.

**Distribution.**—I have found this species at Epping Forest in dry *sphagnum*. Mr. Bostock found it at Stone, Staffordshire, I believe, in a cellar. I do not think that it is common, but it is very small and easily overlooked. I am not aware of its having been recorded hitherto.

HYPOTHONIUS LANATUS,\* *Michael.* Pl. XLIX, figs. 15  
—22.

*Hypothonius lanatus*, Michael. Journ. Roy. Microsc. Soc.,  
ser. ii, vol. v, p. 396.

Average length about ·33 mm.

Average breadth about ·18 mm.

Average length of legs (first pair) about ·12 mm.

Average length of legs (second pair) about ·10 mm.

Average length of legs (third pair) about ·11 mm.

Average length of legs (fourth pair) about ·14 mm.

A species remarkable for its woolly hairs, its power of erecting the spines on its back, and for its singular mandibles.

**Colour** rather light yellow-ochre.

**Texture** dull, reticulated, slightly pulverescent.

**Cephalothorax** small, irregularly reticulated. Rostrum blunt. Lamellæ represented by two low, rough, thick ridges extending far forward. *Rostral, lamellar, and interlamellar hairs, also a pair of hairs at the anterior side of the pseudo-stigmata, and a pair of hairs between these and the lamellar hairs all assuming the condition of bunches of white woolly substance.* The rostral hairs are far the largest of these, which is most unusual. When these woolly hairs are examined with a high power they are seen each to consist of a main stem with a considerable number of branches or pinnæ arising from it, forming a sort of fine brush which holds flocculent matter. Pseudo-stigmata small, near the postero-lateral angles of the cephalothorax. Pseudo-stigmatic organs long, almost straight, directed backward and outward; they have long rod-like peduncles and fusiform heads which are woolly like the before-mentioned hairs; when cleaned the distinction between head and peduncle is not apparent. Palpi

\* *Lanatus*, wool-bearing.

thick, almost conical, projecting slightly beyond the rostrum, but hidden by the rostral hairs from the dorsal aspect; the terminal joint is densely haired, and has one or two very long hairs. The mandible (fig. 16) is small but very remarkable; the fixed arm of the chela is shorter than the movable arm, and is narrowed to a sort of neck before joining the body of the mandible; it has four large teeth; above and close to it is a projection from the body of the mandible, which is rather like a larger copy of the fixed chela, but is more hand-like in form, and cut into five very deep teeth or spikes; above this is the ordinary hair or spine. The movable arm of the chela is long and thin, but does not depart greatly from the usual type. The apodemata are joined to the sternum.

**Legs** rather short, hind pair not reaching the posterior margin; gradually diminished in thickness from the proximal to the distal ends. There are long tactile hairs on the first tibiæ; a whorl of short, curved, rather woolly spines on each of the three central joints of each leg, and the usual fine hairs on the tarsi. Claws monodactyle, long, very little curved.

**Abdomen** somewhat pyriform, slightly truncated anteriorly; moderately arched. The whole *notogaster* is strongly and coarsely reticulated, reticulations about 120 to the millimètre; the ridges of the reticulations not above a sixth of the width of the depressions between them. The abdomen is distinctly divided into four segments; the segments are capable of slight telescopic retraction and extension. On each segment is a row of large, colourless, serrated spines, which usually lie flat on the notogaster, but can be erected, apparently at the will of the animal; all the spines are erected together, never separately; the erection would seem to be due to the movement of the segments. The spines on the second segment are the shortest, and those on the third the longest. Round the posterior margin are about eight short, curved, woolly hairs, like those on the cephalothorax. The genital

and anal plates are close together, the former being the wider.

*Nymph.*

It is like the adult, but white.

**Distribution.**—The creature is uncommon; the largest number I have found were in an old thatched roof, but I have occasionally found single specimens in old wooden boxes, &c., in the most unexpected places. I am not aware of its having been recorded by anyone else.

GENUS—HOPLOPHORA,\* Koch.

*Apterogasterinæ* with cephalothorax hinged to abdomen and capable of being folded down on its ventral surface. Ventral plate not ankylosed to dorsal.

Equals *Hoplophora* of all authors and the *Tritia* of Berlese and Canestrini.

The first record of any creature of this well-marked genus is by Dugès, who did not divide his *Oribatidæ* into genera but called his species *Oribates dasypus*. Dugès' short description without any figure would apply equally well to any species in the genus; it is simply generic. Koch came next; it is to be regretted that he did not adopt some modification (to escape identity with the Linnean genus) of the very appropriate name of *dasypus* for the genus as well as new specific names for all species; he did give new names to the species, and I think to some forms which were not species, but he gave the not very characteristic name of *Hoplophora* to the genus; that name has become

\* ὅπλον, a shield or weapon; φορός, carrying.

so thoroughly well known that it would not be desirable to alter it now by going back to any form of *dasypus*; the result of this is, that acarologists feel bound to preserve the name of *dasypus* for a species, but it is not certain that all refer to the same species when they speak of *dasypus*.

The genus is certainly the most exceptional in the family, in its external anatomy, and as a necessary consequence in its musculation; the other internal parts do not vary so much from the usual type. The most striking peculiarity of the genus, which differentiates it sharply from all others in the family, is that the cephalothorax, instead of being ankylosed to the abdomen, or fixed to it in a manner which admits of little, if any, movement, is here attached by a ginglymous joint, which is very frequently made use of; this joint acts perpendicularly and enables the creature to fold the whole cephalothorax downward and backward, so that its under or sternal surface is pressed against the ventral surface of the abdomen, and the dorsal surface of the cephalothorax is the lowest of all. The creature having the power of entirely withdrawing the legs within the carapace becomes a mere chitinous ball when the cephalothorax is thus folded down (Pl. L, fig. 3). To enable the cephalothorax thus to adapt itself to the form of the abdomen and to enable the legs to be withdrawn a most important modification is necessary in the cephalothorax itself, and accordingly we find that, instead of the rigid sternal surface generally found, which is pierced by a distinct mouth-opening with articulated labium or maxillary lip, and rigid acetabula for the articulation of the legs, the whole sternal surface is soft, membranous, and flexible, and that the dorsal surface only is covered by a chitinous plate more or less shaped like the bowl of a spoon with the convex side uppermost, and which has a distinct edge formed to fit against the abdomen. This plate I propose to call the "aspis;" it often has a strong median carina (*H. magna*, *H. anomala*). The

next peculiarity is in the ventral plate; it will be seen by the description at p. 550, that the ventral plate proper can hardly be said to exist but is merged in the very large genital and anal plates; but referring to the whole of these structures as the ventral plate for the purpose of understanding their joint movement as one plate, we notice that instead of being ankylosed or firmly and almost immovably fixed to the dorsal, as a ventral plate usually is, they are only attached to it by a flexible membrane and are capable of free motion. The mode in which this power is employed is as follows: when the creature, having been closed up, wishes to extend itself and put out its legs the ventral plate is drawn by its levator muscles upwards so as to be nearer to the dorsal surface; the anterior part of the plate is drawn furthest up. This motion leaves less space within the body, and doubtless assists in forcing the legs out; they emerge in front of the concave edge of the ventral plate (Pl. L, figs. 2, 8). When the creature closes up again the ventral plate is drawn downward against the sufflexed edge of the notogastral plate, and the legs are drawn upward into the space so left. Another peculiarity is in the number of joints in the palpi, which will be dealt with at length under the head "palpi."

Berlese proposed making a separate genus ("Tritia") for the species which have tridactyle claws, and the peculiar genital and anal plates of *H. ardua* ('Acari, &c. Ital.,' fasc. vi); he has subsequently abandoned this idea (*ibid.*, Notes, fasc. iii); but Canestrini still retains it ('Prospetto dell' Acarofauna Ital.'), and Berlese himself continues to use the name.

The **Rostrum** cannot be said to exist as a distinct part, and all distinctions of frons, genæ, provertex, and dorso-vertex are entirely lost; but the rostral hairs persist, and are usually rather large, and placed high up on the curve of the aspis.

The **Labium** is not as hard and chitinous, nor as distinctly articulated an organ, as is usual in the *Oribatida*.

*tidæ*, it is small and almost triangular, but terminates anteriorly in a bifid, or rather paired, ligula, each half of which terminates in two hooks or curved hairs.

The **Palpi** are almost cylindrical, and abundantly furnished with long hairs in the distal portion ; Nicolet says that they consist of four joints only, instead of the five generally found in the family, and that the basal joint is as usual very small; the second as usual long, and the largest joint ; and that there is one cylindrical joint between that and the terminal conical joint ; this means that there is only one joint to represent the usual third and fourth joints. Claparède figures and describes five joints ; Berlese says that what he calls *Tritia decumana* (I cannot agree with him that it is Koch's *decumana*) has five joints to the palpus ; he does not mention the number of joints in his other species, but he figures five joints in all except *H. dasypus* (he sometimes omits the small basal joints), amongst those he so figures is *H. anomala*, a well-marked species. In his 'Acarorum Systematis Specimen' he says that *Hoplophora* has four. I have carefully examined my dissections of all the British species, including numerous specimens of the commoner species ; I find in every instance that the palpus is exactly as described by Nicolet, viz. four joints only. The species examined by me include *H. anomala*, and also *H. ardua*, a species closely allied to Berlese's *decumana*, inasmuch as it is possessed of the tridactyle claw, and singularly-formed genital and anal plates upon which he founded his genus *Tritia*. The difference seems probably to be that Claparède and Berlese appear to consider the terminal joint as divided into two near the middle, at a place where there is a small shoulder bearing a hair. It is not so divided in English specimens, so that either the Swiss and Italian must differ from the French and English in this respect, or else I think Claparède and Berlese have fallen into some error in this respect. Canestrini, in his 'Prospetto dell' Acarofauna Ital-

iana,' states that *Hoplophora* has four joints in the palpus, and *Tritia* five.

The **Maxillæ** attain an extreme development in the present genus; they are large, chitinous, somewhat elbowed organs, which when the creature is extended and seen from the side, as it usually is, are very conspicuous (Pl. L, figs. 2, 8); they have the distal end broad and dentate (fig. 9); the dentition varies, but it generally consists of a somewhat rounded exterior or upper lobe, and three or four sharp teeth along the interior or lower portion (*H. magna*). In *H. dasypus* the inner dentition is not so sharp (fig. 9). In *H. ardua* the rounded external part is large, then there is a plain portion, and then two well-marked, but not very sharp, teeth close together at the inner corner.

The **Mandibles** are short, but broad, giving ample room for the powerful muscles which close the chelæ (fig. 5); they are very conspicuous from the side. The dentition is generally close and powerful, often chiefly carried by an inner ridge on the edge of the chela.

The **Lingua** is generally fine and pointed; not always easy to see, being much hidden by the lingula and the epi-pharynx.

The **Pseudo-stigmata** are always small, and are not projecting tubes, but mere holes, provided internally with a sort of grating (figs. 6 and 11); internally they are generally covered by a more or less ovoid capsule (fig. 12), and have attached to them, in the species which I have dissected, the three or more minute cæcal air-sacs which are shown in figs. 11 and 12, and which are more fully considered in vol. i, pp. 173—175. The pseudo-stigmatic organs vary considerably; in *H. dasypus* it requires some care to find them, in *H. stricula* they are very conspicuous; they almost all look filiform if seen on edge.

The **Lamellæ** are entirely absent, not a trace of them is to be found in any species that I am acquainted with.

The **Tectopedia** are also entirely absent, they are not in any way required, and indeed their presence would be inconsistent with the general construction of the animal.

The **Legs** are very differently arranged from what is usual in the family. They seem, when viewed from the side, as if they were all inserted together, almost in a bunch, the fourth pair being nearer to the median line of the body than the third pair, but scarcely set further back (fig. 2); this arrangement is appropriate for enabling them to be withdrawn into the shelter of the carapace, and to escape the anterior edge of the genital plates. They are more or less cylindrical and curved, but are more clinging and crawling than walking or running organs; this is doubtless explained by the wood-boring habits of most of the species. The coxae are usually small joints, the femora considerably the largest, the genua and tibiae of about equal length, the tarsi longer and somewhat conical. The distal joints are generally abundantly furnished with long setiform hairs, and the tactile hairs on the anterior legs are very large. The claws are monodactyle in all British species which I am acquainted with except *H. ardua*, where they are tridactyle. In the monodactyle species the claw is usually of remarkable size, sometimes not very much shorter than the tarsus; it is usually somewhat open in the curve, and considerably thickest in the middle.

The **Abdomen** is exceptional in form, it is almost egg-like; this arises from the fact that the depth from dorsal to ventral surface is as great as, or in some foreign species (*e.g.* *H. arctata*, which Murray says he found in England, but I have not been able to verify the species), much greater than, the width from side to side; and that the notogastral plate, which always maintains its rounded form, is sufflexed largely on to the ventral surface at the sides, and usually, although not invariably, behind, so that the opening for the ventral plate is very small; and it is wholly or

almost entirely filled up by the genital and anal plates, which are ordinarily strongly convex. The abdomen usually bears several longitudinal rows of long, setiform, or rod-like hairs.

The **Genital and Anal Plates** are, as before stated, very large and convex, they are close together, and fill up practically the whole opening of the notogastral plate the genital are usually the wider and squarer, and have a concave anterior margin which facilitates the passage of the legs when retracted or protruded. This edge is not a mere simple edge, but in *H. magna*, *H. dasypus*, &c., first projects a little, forming a ridge directed forward and strongest at the outer angles, then turns upward towards the interior of the body, then rises, forming a second ridge parallel to the first, leaving a deep curved sulcation between, and then passes again perpendicularly upward, terminating in a broad edge, as seen in fig. 13. The exterior lateral edge has an almost similar structure, but the second ridge is not so much developed, and the whole upturned part is smaller. When the aspis is closed down its edge is received by the curved sulcation above named. The anal plates also have the anterior and exterior lateral edges bent upward almost at a right angle, the former slopes a little and thus passes rather under the slightly projecting posterior edge of the genital plates ; at the inner corner of this margin of each anal plate is the singular chitinous projection shown in fig. 13. At the posterior outer angle of the anal plates there is generally a flat, shelf-like projection of some kind, most developed in *H. magna*, which serves as a stop to prevent the plate passing out of the body. There are generally four or five large hairs, thickened in the middle, set just inside the inner edge of each anal plate, and these hairs ordinarily project between the plates. In *H. ardua* a singular arrangement of the genital and anal plates exists, not found, as far as I am aware, in any other creature in the family except probably in the closely allied species which Berlese

calls *Hoplophora (Tritia) decumana*; the genital and anal plates are not separate, but each genital plate is continuous with the anal plate on the same side, and just where the divisions between the genital and anal plates would ordinarily be; the plates on the opposite sides of the body are joined together, first by a short, transverse, chitinous bar, and posterior to the bar by a curious series of interlocking hooks (Pl. LI, fig. 12). Thus the genital and anal plates cannot really open; but, being slightly chitinized, long, and flexible, they are bent outward to admit the passage of the ovipositor, &c. This organ emerges near the anterior end of the plates. Berlese says that there are eight genital plates in his *Tritia decumana*, he does not explain how this is, except by a diagrammatic outline and the short explanation of this drawing, neither of which are clear to me; he seems to me to have treated the dorsal plates, the lateral plates, &c., all as genital plates.

The **Ventral plate** cannot be said to exist as a separate organ, it is reduced to a mere setting for, or partial border to, the genital and anal plates to which it is ankylosed; in *H. ardua* it is not distinguishable from them, and it is usually slightly chitinized and very inconspicuous; generally it is not continuous; in *H. magna* the above-named projection at the outer posterior angles of the anal plates probably represents the ventral plate, but notwithstanding such vestigial structures the ventral plate may be said to have become merged in the enormously developed genital and anal plates.

The **Respiratory system**.—This has been treated of fully in vol. i. I have not found any tracheæ whatever, unless Claparède be correct in considering the three minute air-sacs inside the pseudo-stigmata to be tracheæ, as to which see vol. i, pp. 173, 175, &c.

The **Cæca** of the ventriculus are usually small and almost globular (Pl. E, fig. 2). The alimentary canal is otherwise much of the type ordinary in the family.

The **Ovipositor** is short and thick, the genital suckers very large, usually two on each side (Pl. L, fig. 13).

The **Super-coxal glands** are very well seen in dissections.

The **Nymphs** of this genus, in such cases as I am acquainted with, are soft, yellowish-white creatures, very fat and inactive, and without any aspis; this causes the bulbous part of the mandibles to be seen from the dorsal aspect, and as they are retracted or protruded the creature seems to be altering the shape of the front part of the cephalothorax, and has an appearance somewhat like a *Tyroglyphus*. It was doubtless partly this that caused Claparède to say that *Hoplophora* passed through an Acarus-like stage. Dr. M. Szanislo (in the 'Annalen für Oenologie,' 8te Band, Heft 4, p. 307) has followed this idea further, and actually proposes to treat *Hoplophora* and *Tyroglyphus* as belonging to the same family, or even genus; Haller has very properly answered this ('Entomologische Notizen'). The nymphs have not any power of closing up or withdrawing their legs, &c., still if they be carefully examined it will be seen that, allowing for the entire absence of all hard chitinization in the cuticle, and the effects consequent upon this, they are not so very unlike the adults. As to identifying the nymphs of this genus, see my remarks relative to the nymph of *H. dasypus*.

The **Larvæ**.—Nicolet states that one of the peculiarities of this exceptional genus is that the larva when it emerges from the egg is octopod, and Nicolet paid a good deal of attention to the development of *Hoplophora*. On the other hand, Claparède made this development the subject of a special study, and he states most distinctly that the larvæ when they escape from the egg are hexapod (Clap., p. 515), which is what might be expected. But now comes the most curious part of this disagreement. On referring to Claparède's plates, it will be found that he draws his fully-formed larva (fig. 5), apparently intended to be still within the egg (Clap., p. 514), as octopod; while Nicolet, as far as can be judged from his far less distinct drawing, indi-

cates it as hexapod. I have gone somewhat carefully into this question, and there is no doubt that in the species which I have investigated Claparède is right. I have actually seen the hexapod larva emerge from the egg on the stage of my microscope, and the drawing Pl. LI, fig. 3, was made from a living specimen which I had just seen emerge from an egg laid in my own cell by a *Hoplophora* which I was keeping in confinement.

Claparède says that the larva has a small dermal appendage, like a blunt-ended spine on each side of the ventral surface between the second and third legs, he calls it "Bruststiel," and states that a similar appendage is found upon the hexapod larva of *Tyroglyphus*.

### *Egg.*

In the commoner species this usually has a semi-transparent, slightly chitinized shell, which in the fully formed egg is closely and irregularly wrinkled; in *H. ardua*, however, the mature egg is hard and opaque.

**Development of the Egg.**—I regret that time and opportunity have not been available to enable me to make any embryological studies regarding the *Oribatidæ* which I think of sufficient importance or value to be included in this work, nor do I propose to offer any such with respect to the present genus, but *Hoplophora* stands in a somewhat different position from other genera of the family; in the first place, if a female *Hoplophora* of one of the common species, *dasypus* or *magna*, be dissected, the oviducts will generally be found to contain numerous eggs, perhaps ten to fifteen or even twenty, in various stages of development, and these eggs are sufficiently transparent to allow a good deal of what is taking place within the shell to be seen; secondly, this has tempted Nicolet to give an account of the development based on what could be seen from the exterior, and that account is, I believe, chiefly correct, but there are some points upon which I can-

not quite agree with him ; I think, therefore, that a short note, explanatory of what may be seen by ordinary observation, without special preparation and without cutting sections of these minute bodies, may be useful to the student. Taking *H. magna* as a type, the egg is formed in the ovary, and up to the time of leaving that organ is a minute, almost globular body, attaining, perhaps, .10 mm. in diameter, and consisting of a delicate membranous sac filled with very clear, almost fluid, very homogeneous contents, but in which the centrally placed germinal vesicle was detected by Nicolet. The first one or two eggs in each oviduct are much of the same nature, and not greatly larger ; in the second egg, however, it will usually be seen that the contents have become a little more opaque toward the centre, leaving a more hyaline portion exteriorly ; and of course the size is a little increased (see Pl. LI, fig. 2 a). The third or fourth egg usually shows a very marked change, it loses the globular shape, and becomes elongated, and attains nearly its full length ; it may now be nearly .2 mm. Segmentation commences, and proceeds very rapidly, extending over the whole egg ; the membrane also becomes somewhat thickened. One of the eggs in this condition is figured at fig. 2 b. A delicate inner membrane has now formed, which becomes slightly invaginated at the oral pole, and a space appears along one side, apparently below what will ultimately become the ventral surface of the embryo (fig. 2 c). The external membrane of the egg now commences to be irregularly wrinkled or corrugated towards the oral end, the membrane and yolk contents remaining comparatively unaltered at the aboral end. While this is taking place certain delicate brownish formations appear within the membrane, looking like very fine chitinous blades or rods ; of these two paired curved pieces near the oral pole might possibly indicate the formation of the mandibles ; a short blade along each side sloping upward, and another nearly meeting it and sloping downward might indicate

the first sign of legs (see fig. 2 *d*, where, however, in consequence of the position the curved pieces do not show). The wrinkling of the outer membrane gradually extends over nearly the whole egg, the formations mentioned above become larger, darker, and more chitinous, and numerous others make their appearance (fig. 2 *e*) ; until, in the most mature eggs of the series, there are, in addition to those above named, a strong crescent-shaped piece between the two sloping pieces, four pairs of smaller crescent-shaped pieces, each apparently bordering the outside of a small papilla, presumably along the ventral surface ; a broken series of short straight pieces between them ; and some other less important pieces (fig. 2 *f, g*). The egg now has the appearance of containing a formed embryo, which almost fills it ; and of which the mandibles, four pairs of legs, the sternum and other organs, are chitinized and brown, and can be distinctly seen. Nicolet seems to treat this as being the case, and it is difficult to persuade oneself that it is not so ; the whole of the formations are quite constant, found practically alike in all eggs which have attained a sufficient degree of maturity, and I cannot help thinking that they must be in some way connected with the development of the larva, but how I cannot explain ; for it is absolutely certain that when the larva emerges the whole of these formations are left behind on the eggshell, to the inner surface of which they are attached ; and the larva is a clear, white, translucent creature, without a sign of chitinization or brown colour about it ; and if an egg in the state figured (*f, g*) be dissected no formed embryo is detected, but the whole ovum appears to be in an immature condition.

The egg is not ever found in the oviduct in a more advanced stage than that last described ; it is now laid in a small hole or pit in the wood. After a time—as to the duration of which I am uncertain, and which probably varies—the egg begins to swell ; it does not

become longer, but the diameter and consequently the bulk increase greatly ; it thus again becomes comparatively globular, but not quite so ; the wrinkles are almost lost, and the outer membrane becomes detached from the larva, which may soon be seen moving freely inside. The young *Hoplophora* now ruptures the egg-membrane and escapes ; when it emerges it is, as before stated, hexapod and quite white and translucent ; the abdomen is wrinkled, and has not expanded to its ultimate form, which it only attains gradually. The larva just emerged is depicted at Pl. LI, fig. 3, and the egg-shell which it has left at fig. 4.

**Habitat.**—The common species are essentially wood-boring creatures, not eating into sound, solid wood, but taking advantage of what is already partly decayed. The nymphs are found within the wood ; the adults either in the same situation or on the moss, &c., on its surface. They may be found elsewhere, but not so abundantly. I have not found enough of the rarer species to judge properly of their habitats, but the few specimens of *H. anomala* which I found were in moss growing on the ground on the chalk hills, but there was wood not far off.

*Table to assist in the identification of the British species of Hoplophora.*

|                                                         |                            |                                                                                              |           |
|---------------------------------------------------------|----------------------------|----------------------------------------------------------------------------------------------|-----------|
| Claws monodactyle, abdomen rounded posteriorly          | Aspis with a median carina | Progaster plain, without any projection . . . . .                                            | MAGNA.    |
|                                                         |                            | Progaster with a large square, shelf-like projection overhanging the cephalothorax . . . . . | ANOMALA.  |
|                                                         | Aspis without any carina   | Pseudo-stigmatic organs very short and lanceolate, cuticle smooth . . . . .                  | DASYPUS.  |
|                                                         |                            | Pseudo-stigmatic organs long and sickle-shaped, cuticle pitted . . . . .                     | STRICULA. |
| Claws tridactyle, abdomen pointed posteriorly . . . . . |                            |                                                                                              | ARDUA.    |

HOPLOPHORA MAGNA,\* Nic. Pl. L, figs. 1—7; Pl. LI,  
figs. 1—4; Pl. D, figs. 2,  
14; Pl. E, fig. 2; Pl. F,  
fig. 17.

*Type species.*

*Hoplophora magna*, Nic. P. 472, pl. ii, figs. 1 to 1g; pl. x,  
figs. 4 to 4f.  
— — — Haller. P. 307.

Length varies at least from about .90 mm. to about 1.30 mm., probably more.

Average breadth of a specimen 1.05 long about .55 mm.

Average depth (from dorsal to ventral surface) of same sized specimen about .55 mm.

Average length of legs (all pairs), in same sized specimen about .35 mm.

This species varies in size greatly, it is one of the largest of the British Oribatidæ. Nicolet gives its length as 1.46 mm. I have not found the British specimens as large as this.

**Colour** lightish oak-brown, sometimes with a reddish tint, and sometimes darker than the typical shade. Legs reddish.

**Texture** dull, without the least gloss, coarsely pitted or reticulated, the pits round, irregularly placed, varying in size in different specimens and in different parts of the same specimen, those on the cephalothorax finer than those on the abdomen, the latter averaging about sixty to the millimètre. Ridges between the pits usually not so wide as the pits.

**Form**.—A long oval; when seen from the side a somewhat broader oval.

**Cephalothorax**.—Aspis with a *strong, rough, longitudinal median carina*, not reaching the anterior or

\* *Magnus*, large.

posterior margin; lower edge of aspis undulated, narrowest posteriorly. The aspis is divided into two portions by a transverse line just behind the carina, the front portion is far the larger, and is domed and pitted, the hinder part is band-like, and marked with subparallel curved ridges inclining toward the centre. Mandibles and maxillæ very large, palpi showing from the lateral aspect. Pseudo-stigmata close to the lower edge and almost at the back of the aspis. Pseudo-stigmatic organs short and fine, filiform if seen on edge, widest in the middle if seen laterally; straight just where they emerge from the pseudo-stigmata, but almost immediately curving strongly upward and outward, so as to be sickle-shaped. The three short tubular air-sacs inside the pseudo-stigmata are figured at Pl. D, fig. 14. There are a pair of setiform hairs on the highest part of the aspis, and one on each side of the carina.

**Legs** rather long for the genus; the femora of the first two pairs long and thinner than the genua and tibiæ if seen from above; femora of the two hind pairs shorter. Tactile hairs on first pair of legs very long; tarsi thickly clothed with long fine hairs, a few similar hairs on the other joints. Claws very large. Monodactyle.

**Abdomen** a long oval, truncated anteriorly, rounded posteriorly, curving down to the cephalothorax; pro-gaster not furnished with any chitinous, shelf-like projection overhanging the cephalothorax. Posterior margin of the notogaster much returned on to the ventral surface, where its edge forms a small median projection behind the anal plates. Genital and anal plates large, approaching square, about equal in size, but the genital are rather the wider, and the anal plates rather the longer; three or four long hairs generally project between these plates. There are two rows of long rod-like hairs on the notogaster, and two rows of smaller similar hairs along each side of the abdomen.

*Nymph.*

This creature will be much more readily understood from the drawing (fig. 4) than from any description. It is a fat, soft, yellowish-white, inert creature, which can scarcely stand upright on a plane surface, it falls on its side almost immediately. From the dorsal aspect little can be seen except the large rounded abdomen and the upper bulbous part of the mandibles; these are not covered by any aspis, as in the adult; otherwise the two are really much alike if the want of hard chitinization be taken into account. The point of the dorsal plate, which curls under behind the anal plate in the adult, is represented by a larger mamilliform termination to the abdomen of the nymph, which does not curl under.

**Distribution.**—Common and generally distributed. The species has been recorded in France and Germany. It is a wood-boring species, but may be found in moss on the wood.

**HOPLOPHORA ANOMALA,\* Berlese.** Pl. LI, figs. 5, 6.

*Hoplophora anomala*, Berlese. Acari, &c. Ital., fasc. vi, pl. v.  
— — — G. Canestrini. Prosp. dell' Acarofauna Ital., p. 47.

Length varies, at least, from about .75 mm. to about 1.60 mm., probably even more.

Depth, from dorsal or ventral surface, of a specimen 1.50 mm. long, about .70 mm.

Length of first and second pairs of legs in same sized specimen about .42 mm.

Length of third and fourth pairs of legs in same sized specimen about .49 mm.

This singular species was originally found by Professors Canestrini and Berlese in the Patavian and

\* Ἀνώμαλος, unequal, anomalous.

Roman districts. It may be readily distinguished by the large, square, chitinous projection from the progaster.

**Colour** darkish yellow-brown to red-brown.

**Texture** dull, coarsely pitted all over with wide but shallow pits about 60 to the millimètre, which often cannot be seen in specimens mounted in balsam.

**Form** almost elliptical, rounded posteriorly.

**Cephalothorax** with a strong, longitudinal median carina, not reaching the anterior or posterior margin; aspis divided into two portions just behind the carina, the front portion is far the larger, and is pitted; the hinder part is marked with rather indistinct, subparallel, longitudinal curved ridges. Cephalothorax rather shallow in the arch; rostral portion curved, posterior portion straighter. A pair of fine curved hairs just in front of the carina may be considered the rostral hairs. Palpi showing plainly from the lateral aspect. Maxillæ and mandibles not very large for the genus, the latter slightly but distinctly dentate. Pseudo-stigmata rather conspicuous for the genus, not at all hidden. Pseudo-stigmatic organs of moderate length, setiform, somewhat recurved. Interlamellar hairs long, setiform, directed forward almost horizontally.

**Legs** moderately long, the two hinder pairs are the longer, abundantly provided with long setiform hairs; claws monodactyle.

**Abdomen** rounded posteriorly, greatly arched; there is a large, squarish, chitinous, shelf-like projection from the progaster occupying nearly its whole width, and overhanging the cephalothorax when the creature is extended, but standing free in the air when the animal is closed up. The anterior edge of this projection has a notch to fit the carina of the cephalothorax. There are two longitudinal rows, of about five very long setiform hairs each, on the notogaster, and two rows of shorter similar hairs on each side. Genital and anal plates large and about equal in size, the former almost square, the latter rounded posteriorly. The dorsal

plate is somewhat sufflexed on to the ventral surface posteriorly, and has a small median point directed forward over the anal plates.

I am not acquainted with the immature stages of this species.

**Distribution.**—I have found a few specimens in moss on the ground on the chalk hills near Gomshall, Surrey; this is the only instance that I know of when it has been taken in England; it has been recorded in Italy.

### HOPLOPHORA DASYPUS\* (*Dug.*). Pl. L, figs. 8—14.

*Hoplophora dasypus*, Dugès. Ann. Sc. Nat., ser. ii, t. ii, p. 47.

- — Can. e Fan., p. 105?
- — G. Canestrini. Prosp. dell' Acarofauna Ital., p. 46?
- — Berlese. Acari, &c. Ital., fasc. vi, fig. 4?
- — *nitens*, Langle. Unpublished.
- — Nicolet. P. 423.

*Phthiracarus contractilis*, Perty.

*Hoplophora* — Claparède. Studien an Acariden, p. 507.

- — Murray. P. 222.
- — *decumana*. Koch. Heft 2, fig. 9.
- — — Haller, P. 307.
- — *lucida*, Koch. Heft 32, fig. 14.
- — *lentula*, — Heft 32, fig. 16.

[This species is not the *Hoplophora decumana* of Berlese.]

Length varies at least from about .5 mm. to about 1.30 mm., probably even more.

Depth, from dorsal to ventral surface, of a specimen 1.10 mm. long, about .55 mm.

This is the original species of *Hoplophora*, it is also the common kind; it varies so widely in size that I hesitated to consider all as one species, but I am unable to find any difference except size between the specimens, and every intermediate size between the extremes may be found, and *H. anomala* varies nearly

\* *Dasypus*, an armadillo; from δασύς, hairy, and πούς, a foot.

as much ; *H. magna* also varies considerably. It will be seen that I have put a query to the Italian references. Canestrini's description and Berlese's figure, of the pseudo-stigmatic organ do not quite agree with the English specimens ; there may be two species, if so it would not be possible to say which is Dugès' original *dasypus*. Nicolet does not say what the pseudo-stigmatic organ of his *H. nitens* is like, he describes that of *H. stricula*, so presumably if he had seen it in *nitens* he would have described it there also, from which we may judge that it was very small, as in the present species ; his seems to have been the abundant species. Berlese describes the pseudo-stigmatic organs as short and simple ("simplex"), but he figures them long and simple, and also identifies his species with Claparède's *H. contractilis* which has pseudo-stigmatic organs short but not exactly simple ; they are excellently figured and described by Claparède, and there is no doubt that Claparède's species is identical with mine.

**Colour** varies with age and size, from pale drab to dark chestnut, or red-brown.

**Texture** always smooth, sometimes highly polished in life ; in most prepared specimens a fine granulation of the inner layer of the cuticle is seen through the outer layers.

**Form**, a rather short oval, almost elliptical, *rounded posteriorly*.

**Cephalothorax** smooth, *without any carina*, moderately deep in the arch ; curved in the rostral portion, almost straight posteriorly ; a pair of fine short hairs on the curve may be considered the rostral hairs. Palpi showing plainly from the lateral aspect ; maxillæ and mandibles large and powerful, finely dentate. Pseudo-stigmata very small, almost hidden by the pro-gaster. Pseudo-stigmatic organs also very small, generally difficult to see except in dissections, they are curved, flattened, and lanceolate on a short peduncle (Pl. L, figs. 11 and 12). The three small air-sacs

within the pseudo-stigma are shown in fig. 12. Inter-lamellar hairs near together, long, fine, setiform, usually almost horizontal and not easily seen.

**Legs** rather short, the two front pairs the thicker, when seen from the side, and having the femora longest. Claws monodactyle, very large; almost as long as the tarsi. Tactile hairs on the first pair of legs very long; all the tarsi thickly clothed with long hairs, and several longish hairs on the other joints.

**Abdomen** somewhat truncated anteriorly, very round posteriorly, somewhat globose in form. There are two longitudinal rows of a few long setiform hairs on the notogaster, and two rows of similar shorter hairs on each side. Genital and anal plates large, the former the broader, and squarish, the latter coming almost to a point posteriorly. The dorsal plate is not much sufflexed on to the ventral surface posteriorly.

### *Nymph.*

I do not think that anyone would distinguish this nymph from that of *Hoplophora magna* except by breeding it, and even when this is done it is far from easy to be sure that the right nymph has been kept under observation, because both are wood-boring creatures; and even if the observer is certain that the creature he wishes to rear comes from an egg of *H. dasypus*, yet in order to keep it alive he must allow it to burrow into decayed wood, and it is almost impossible to be sure that this wood does not contain eggs or young of *H. magna*, unless it be submitted to processes which would unfit it for food. This nymph is well figured by Claparède (his Plate XXXIV, figs. 3, 4). It is a fat white lump, and the figure and description which I have given above for the nymph of *H. magna* will practically apply to this also.

**Distribution.**—The creature is a wood-boring species, and is found in the moss growing on the wood;

it is usually rather decayed wood which it selects. It is extremely common and generally distributed. It has been recorded in France, Germany, Switzerland, and probably in Italy.

HOPLOPHORA STRICULA,\* Koch. Pl. LI, fig. 7.

*Hoplophora stricula*, Koch. Heft 2, fig. 10.  
— — Nic. P. 472, pl. x, fig. 5.  
— — Haller. P. 307.

Average length about .52 mm.

Average breadth about .28 mm.

Average depth, from dorsal to ventral surface, about .24 mm.

Average length of legs (first pair) about .13 mm.

**Colour** light pinkish fawn-colour. Legs rather darker and redder.

**Texture** dull, semi-transparent; chitin very thin and brittle; strongly pitted, pits about 100 to the millimètre.

**Cephalothorax** rather short, rounded anteriorly, moderately deep in the arch; without any carina, pitted; rostral portion curved; a pair of hairs on the curve may be considered the rostral hairs; posterior portion almost straight, in median outline, and bearing a few longitudinal curved ridges at its hinder part. Pseudo-stigmata fairly large, but placed far back; the *pseudo-stigmatic organs long*, the same shape as those of *H. magna*, i. e. sickle-shaped, there being short straight pieces where they issue from the pseudo-stigmata, after this they curve sharply and suddenly, at first forward and upward, but the distal portions backward and downward (they being more than a semi-circle). Interlamellar hairs short, rod-like, placed far back.

\* *Striculus*, a stripling.

**Legs** rather short, of the type usual to the genus, the first pair the largest. Claws monodactyle, large. Legs amply provided with long setiform hairs.

**Abdomen** almost elliptical, rounded posteriorly and anteriorly. There are four longitudinal rows of large, almost rod-like, blunt-ended, very slightly imbricated hairs on the notogaster, and two rows of similar hairs on each side. Genital and anal plates large, of about equal size, nearly square, but the latter rounded posteriorly. The dorsal plate is sufflexed on to the ventral surface posteriorly, and there has a very small median point directed forward.

I am not acquainted with the immature stages of this creature.

**Distribution.**—I have only seven or eight specimens, three or four of which I obtained amongst the dead leaves in a mole's nest in Warwickshire, and the others amongst dead leaves in a wood near Stone, Staffordshire. I suspect, however, that it is really not a great rarity, but easily overlooked by being mistaken for a small, lately emerged specimen of one of the common species (*dasyphus*).

#### HOPLOPHORA ARDUA,\* Koch. Pl. LI, figs. 8—15.

*Hoplophora ardua*, Koch. Heft 32, fig. 15.

Average length about .80 mm.

Average depth from dorsal to ventral surface about .40 mm.

Average length of legs (first and fourth pairs) about .36 mm.

This, as mentioned in treating of the genus, would belong to Berlese's genus *Tritia* if that genus were admitted. The species is easily distinguished from all

\* *Arduus*, steep, difficult.

other British species which I am acquainted with by its *tridactyle claws and pointed abdomen*. I believe that the British species is Koch's *H. ardua*; but, as so often happens, it is very difficult to arrive at any certainty from the drawings and descriptions of that author; he refers to the abdomen as being more polished than is usual in British specimens.

**Colour.**—Generally not even all over the creature but varying through several shades of light yellow-brown and red-brown. The whole creature has a semi-transparent effect; legs almost yellow.

**Texture** ordinarily dull without gloss, abdomen occasionally more polished; the whole marked with a multitude of very fine undulating lines which are not parallel but rather alternate; these give the creature a granular appearance. The whole dorsal surface is frequently covered with fine powder, like the bloom on a plum.

**Form.**—A longish oval *pointed posteriorly*.

**Cephalothorax.**—Aspis flat and shallow compared with those of other British species. Palpi large and conspicuous (from the side). Maxillæ large, nearly straight externally, strongly elbowed internally; divided into one large lobe and two well-marked smaller lobes, each lobe being double (in the thickness of the maxilla). Pseudo-stigmata not hidden. Pseudo-stigmatic organs long, filiform, standing nearly upright, very slightly thickened towards the distal end. *Interlamellar hairs* very long, setiform. Two double ridges start, one from above and the other from below and behind each pseudo-stigma, and run forward along the side of the aspis to its lateral edge; the lower is much the shorter, and they are further apart distally than proximally. There are two pairs of setiform hairs along the median line of the cephalothorax besides those before mentioned, the hinder pair is much the longer; they may be the homologues of the lamellar and rostral hairs, but are not similar in position.

**Legs** short; of the ordinary form in the genus;

rather densely haired, terminated by *tridactyle*, heterodactyle claws.

**Abdomen.**—Truncated anteriorly, *pointed posteriorly*, rather long-shaped, much rounded at the sides. There is a row of about seven long, setiform, flexible hairs on each side of the median line; and another row of two or three hairs nearer to the side of the abdomen. The genital and anal plates are very singular, they are not really separate, each genital plate having apparently coalesced with the anal plate on the same side of the body where the edges touch. The two genital plates appear also to have coalesced at their posterior angles; and the antero-lateral terminations of the anal plates are joined by four or five singular interlocking processes from each side which look like rack-work. The plates therefore appear not to open in the ordinary way, but from their flexibility; and the ovipositor is extruded between the anterior extremities of the genital plates. The plates project considerably, and bear, the anal about five and the genital about six, pairs of setiform hairs on their inner margins.

**Distribution.**—The species is not common, but is fairly widely distributed; I have found it at Epping Forest, at Dorking in Surrey, and at Stone in Staffordshire; it lives in dead wood. It has been recorded in Germany (near Regensburg). A very similar species has been recorded in Sicily by Berlese,\* who considers his species to be identical with the *Hoplophora decumana* of Koch (in which I do not agree with him) but forms a new genus, *Tritia*, to receive it; his species is much larger, has an abdomen rounded posteriorly instead of pointed, and homodactyle claws instead of heterodactyle; otherwise it resembles the present species.

\* 'Acari, &c. Ital.,' April, 1883, fasc. vi.

DESCRIPTIONS OF SPECIES BELONGING TO GENERA INCLUDED  
IN VOL. I, WHICH HAVE BEEN DISCOVERED SINCE THE  
PUBLICATION OF THAT VOLUME.

GENUS—SCUTOVERTEX.

*Amended Table to assist in the identification of British species of Scutovertex, including those discovered since the publication of vol. i.*

|             |   |                                                                                                                                                                                                    |             |
|-------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Terrestrial | { | Lamellæ blade-like; pseudo-stigmatic organs long; a space of transparent smooth chitin on abdomen, near the progaster; pits in centre of notogaster much larger than peripheral markings . . . . . | SCULPTUS.   |
|             |   | Lamellæ mere thickened bars; pseudo-stigmatic organs short; no smooth space; markings of notogaster about the same size all over . . . . .                                                         | MACULATUS.  |
| Aquatic     | { | Claws tridactyle; markings on notogaster ridges usually more or less zig-zag . . . . .                                                                                                             | CORRUGATUS. |
|             |   | Claws monodactyle; markings on notogaster chiefly dots . . . . .                                                                                                                                   | BILINEATUS. |

SCUTOVERTEX CORRUGATUS,\* sp. nov. Pl. LIV, figs 1—7.

Average length about ·68 mm.

Average breadth about ·42 mm.

Average length of legs (first and third pairs) about ·45 mm.

Average length of legs (second pair) about ·42 mm.

Average length of legs (fourth pair) about ·50 mm.

A species of rather striking appearance.

Colour very dark brown.

\* *Corrugatus*. wrinkled.

**Texture** dull.

**Cephalothorax** rather short and broad (the figure is as usual, somewhat foreshortened, the rostrum being held downward). Rostrum blunt, slightly trifid; rostral hairs very fine. Lamellæ straight ridges, not differing in nature from the other ridges on the cephalothorax and abdomen. Pseudo-stigmata small tubes, rather dorsal, quite unmistakeable, strongly corrugated internally. Pseudo-stigmatic organs small, with very short peduncles, and small, apparently almost globular heads; these, however, when dissected out and examined with a higher amplification, are found to be cup-shaped. Apodemata strong, and rather conspicuous, not quite reaching the sternum, which is not clearly marked. The dorsal surface of the cephalothorax has some ridges, of which one pair, running from the pseudo-stigmata across the base of the lamellæ, are straight and tolerably constant; the other ridges are irregular, and not similar in different specimens. There are, however, two more or less longitudinal ridges between the median line and the lamellæ, and these two may join anteriorly, and there are often some short transverse ridges.

**Legs** long for the genus; fourth pair passing the hind margin by the whole length of the tarsi, and more than half the length of the tibiæ. The joints are of almost even thickness throughout. The peduncles of the first two pairs of legs are rather long and thick. The legs are somewhat smoother and lighter in colour than the body. Hairs on the legs small and fine. Claws tridactyle.

**Abdomen** almost elliptical, somewhat narrowed anteriorly; it is difficult, if not impossible, to say where the abdomen finishes and the cephalothorax begins. The notogaster is arched, but not strongly, and is ornamented with a number of clearly defined ridges, which vary greatly, no two specimens being alike. The main ridges are mostly longitudinal, but are not often quite straight; they usually have a tendency to

a zig-zag form. The ridges on the anterior portion of the abdomen, near the progaster, are, however, chiefly transverse, and usually one or two near the posterior end are also transverse. There are, perhaps, most frequently five or six of the anterior transverse ridges, and ten or twelve of the longitudinal; the latter are ordinarily separated by a space three or four times as wide as the ridge. From the main ridges generally, but not invariably, spring a number of short, irregular ridges, not quite so thick; they are more or less at right angles to the main ridge, and thus cross the interspace between one main ridge and the next, but they do not usually quite reach the next main ridge; they may do so. Sometimes they anastomose with the secondary ridges from the next main ridge, forming an irregular network. The whole of these markings, both main and secondary ridges, are most variable and uncertain. The ridges at and near the progaster project much further forward at the sides than in the middle; where they run backward, forming a broad, squarish indentation. The secondary ridges are, perhaps, more clearly seen in the preparations than in the living specimens: the contrary is the case with regard to the main ridges. There are four longitudinal rows of about four to six extremely fine, short hairs on the notogaster; it is often easier to see the small papillæ from which these hairs spring than the hairs themselves. The ventral plate is considerably smaller than the dorsal, which is sufflexed. Genital and anal plates not very near together, the former almost square, the latter larger and pentagonal or pyriform.

### *Nymph.*

I have never seen this nymph alive, and of course have not ever bred it, I therefore, according to my usual habit, refrain from describing it; but Mr. Bostock, the discoverer of the species, is of opinion

that it would be very difficult to distinguish what he believes to be the nymph of this species from that of *S. sculptus*, except possibly by the shorter pseudo-stigmatic organs. This opinion seems to be confirmed by the appearance of the larvæ which, as mentioned below, I dissected out of the body of the female after death, and after it had been kept for some time in preservative liquid; it frequently occurs, however, that markings on the cephalothorax or abdomen of larvæ or nymphs which might have distinguished them in life are lost in preserved specimens.

**Distribution.**—This species was discovered by Mr. E. Bostock in water crawling on fresh-water algæ (*Prasiola stipitata* and *Cladophora fracta*); where the fresh water was dripping over the rocks close to the sea, but not where the sea would come, at Puffin Island, North Wales; it was tolerably abundant there when he found it in the summer of 1886, but it has not to my knowledge been found anywhere else as yet. The name is given to it by its discoverer.

**Viviparity.**—In the first vol. of this work (page 72) I have stated my belief that one species of the present genus, viz. *S. maculatus*, was frequently, or at some seasons of the year, if not always, viviparous or ovo-viviparous. This view receives considerable confirmation from the present species, and *S. bilineatus*, as Mr. Bostock has actually witnessed the birth of living larvæ from living females of these species; and in the case of *S. corrugatus* I have myself dissected out of the body of a dead female, which had been preserved in dilute acetic acid, no less than seven larvæ, all fully formed and apparently of about the same age and size, but I was not able to detect that they were enveloped in any eggshell or membrane.

SCUTOVERTEX BILINEATUS,\* sp. nov. Pl. LIV, figs. 8—16.

Average length about .62 mm.

Average breadth about .42 mm.

Average length of legs (first pair) about .38 mm.

Average length of legs (second and third pairs) about .36 mm.

Average length of legs (fourth pair) about .40 mm.

A species rather like *S. maculatus* but sharply defined by being monodactyle, and by the absence of external pseudo-stigmatic organs.

**Colour** dark brown.

**Texture** dull and rough.

**Cephalothorax** rather short and broad. Rostrum blunt; rostral hairs very fine. Palpi with short, spike-like hairs on the terminal joint. Maxillæ peculiar, having a single sharp indentation about the middle; with a small, black denticle in the depression. Lamellæ thick, badly-defined ridges, usually joined anteriorly by a more or less perfect, transverse, similar ridge, probably the translamella. Between the lamellæ, in the median line, is a broad longitudinal ridge, also ill-defined and not reaching the translamella. The whole space between these ridges, and, indeed, the whole dorsal surface of the cephalothorax, is covered with large, irregularly-scattered, rough, raised dots. *No pseudo-stigmata nor pseudo-stigmatic organs visible.* Apodemata short, not joined to the sternum; the anterior pair, which are the longest, are singularly turned within the body; like a portion of a steamer's screw.

**Legs** rather long; fourth pair passing the posterior end of the abdomen by about the length of the tarsi. The legs are such as are usual in the genus, but the enlarged ends to the tarsi are small. The outsides of

\* *Bis*, twice; *linea*, a line.

the femora are sculptured, almost reticulated. The claws are *monodactyle*, but there is a minute projection at each side of the claw, and two longish, fine hairs, sharply hooked at their distal ends, on each side of each claw; other hairs on the legs chiefly very short, slightly thickened, or spike-like, some; when seen by a high amplification, of almost laurel-blade form, and somewhat dark in colour. Tactile hairs and some of those on the tarsi fine as usual.

**Abdomen** almost elliptical, slightly narrowed anteriorly, or it may be called more oval; only slightly arched, the edges being sharply deflexed. Where this bending downward commences, on each side, is a slight, ill-defined ridge; or, in some specimens, only a sudden, slight sinking of the margin. On the anterior narrowed part of the abdomen are usually three or four more or less transverse, broad, irregular ridges; from immediately behind these, in most specimens, two rather broad longitudinal ridges run backward until a short distance from the hind margin; these two ridges enclose a central parallelogram not quite a third of the width of the whole notogaster. It is from these ridges that the species is named; they are not, however, usually regular single ridges, but are broken up into two or more lengths, which often overlap, or spring one from the other. In some specimens they are almost or entirely absent, when the creature looks very like *S. maculatus*. Behind the longitudinal ridges, and often joined to their posterior ends, are two or three transverse ridges, mostly having a bend forward about the middle, but the whole of the markings are irregular and subject to considerable variation. The whole notogaster is strewn with dots similar to those on the cephalothorax, but perhaps a little larger; these dots average about eighty to the millimètre; they give the abdomen a very broken outline. Ventral surface rough with irregular, ill-marked ridges and depressions. Genital and anal plates large, near together; the former very square, the latter pentagonal and elongated.

*Nymph.*

It would not be easy to distinguish this nymph from that of *S. sculptus*, both being variable creatures, were it not for the absence of external pseudo-stigmatic organs in the present species.

**Colour** usually dark rich umber-brown with a greenish tinge; rostrum darker.

**Texture** dull and leathery.

**Cephalothorax** conical, rather long, broad at the base, irregularly dotted, and with wrinkles which enclose a more or less square space on the posterior part of the dorsum of the cephalothorax, and a more or less triangular space on the rostrum, which usually has a sort of median carination; and there are irregular wavy wrinkles at the sides of the square space. These markings, however, vary in different specimens. Rostrum somewhat truncated; rostral hairs near together. No external pseudo-stigmata nor pseudo-stigmatic organs visible.

**Legs** much like those of the adult but shorter (particularly the tibiae); the femora of the two front pairs have not the thin proximal ends. The unguis are dark coloured.

**Abdomen.**—Progaster rather concave: it is the widest part of the body; the lateral edge immediately behind it forms a lobe, behind which the abdomen narrows slightly and gradually to the rounded hind margin. Notogaster almost flat, deeply corrugated by irregular waved wrinkles of the cuticle, a few of which run on to the corner of the cephalothorax, cutting off a triangle on each side. Probably the wrinkles do not agree in any two specimens, but it is perhaps the commonest form that a few of the wrinkles, about six or seven, run more or less parallel to the progaster, but become shorter as they recede from it; and that those on the central part of the notogaster are wholly irregular; while those at the posterior end curve

forward ; and those at the sides are longitudinal but deeply undulated. Sometimes almost all the central wrinkles are transverse. There are two longitudinal rows of very short light-coloured hairs on the notogaster.

**Distribution.**—Mr. E. Bostock discovered this species at Bull Bay, in Anglesea, and along the adjoining coast, in small pools of fresh water by the streams, on algæ (*Prasiola stipitata*), chiefly crawling on the weed and on the rocks at the bottom ; it was in great numbers, but it has not, to my knowledge, been found elsewhere as yet. The name was selected by Mr. Bostock.

It is very interesting to observe the absence of pseudo-stigmatic organs, which I have before remarked in *Oribata sphagni* and the nymph of *Hermannia bistrigata*, both aquatic or amphibious creatures. In the present instance I have failed to discover any trace of pseudo-stigmata or pseudo-stigmatic organs either by dissection or otherwise.

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DESCRIPTIONS OF NYMPHS, ETC., OF SPECIES THE ADULTS  
WHEREOF HAVE BEEN DESCRIBED IN VOL. I, BUT THE  
LIFE-HISTORIES OF WHICH HAVE BEEN TRACED SINCE  
THE PUBLICATION OF THAT VOLUME.

**PELOPS PHÆONOTUS.** Pl. LII, fig. 1. (Adult described in vol. i at p. 216.)

*Nymph.*

**Colour** light brownish-bay or brownish-salmon.

**Texture** dull, leathery.

**Shape** long-pyriform.

**Cephalothorax.**—Rostrum moderately sharp, conical; cephalothorax behind the rostrum almost parallel-sided

as far as the insertion of the first pair of legs, then bulbous; without markings. Rostral hairs long. Pseudo-stigmatic organs rather long, with thin peduncles and fusiform heads. Interlamellar hairs long, setiform.

**Legs** rather short, fourth pair not extending far beyond the posterior margin; provided with fine curved hairs, mostly set in whorls.

**Abdomen** with lateral and posterior portions sharply raised, central portion slightly arched. Whole abdomen a series of wavy transverse ridges or folds, irregularly parallel; those near the posterior margin mostly bend forward. There are about five pairs of long, nearly straight or slightly curved, setiform spines on the lateral margins; these spines increase in length from the anterior to the posterior, and point outward and somewhat backward: there are also a pair of rather shorter similar spines on the hind margin, rather far apart.

**Distribution.**—The specimens which were reared were found at Keswick in Cumberland.

ORIBATA EDWARDSII. Pl. LIII, fig. 1. (Adult described in vol. i at p. 229.)

*Nymph.*

**Colour** dark bronze-brown; the internal organs are partly seen through the notogaster, and generally give a greenish effect.

**Texture** polished.

**Cephalothorax** simple, without markings. Rostrum blunt, rounded; rostral hairs short and curved. Pseudo-stigmatic organs of moderate length, with short peduncles and ovate heads not very clearly marked off from the peducles. Interlamellar hairs long, setiform.

**Legs** of medium length, fourth pair scarcely passing

the hind margin ; of about even thickness throughout ; amply furnished with fine hairs, chiefly curved, and in whorls.

**Abdomen** without markings, but with a slight ridge along the progaster ; oval, rounded, and slightly truncated anteriorly ; pointed posteriorly ; considerably arched. There are about six pairs of strong setiform hairs along the lateral and posterior margins, gradually increasing in length from the progaster to the posterior end ; and there are three pairs of similar but rather smaller, hairs forming two longitudinal lines near the middle of the notogaster.

CEPHEUS BIFIDATUS. Pl. LII, figs. 2, 3. (Adult described in vol. i, at page 290.)

*Nymph.*

This singular and beautiful creature is decidedly of the type of the nymphs of *Tegeocranus latus* and *T. dentatus*, and strongly resembles them ; but the spines bordering the abdomen are far longer and more slender in the present species ; and the processes from which they spring are much smaller, indeed unimportant, and of entirely different form.

**Colour** very light buff or drab, almost white ; legs and rostrum light pink-brown.

**Texture** rough, granular, almost glittering.

**Form** elliptical ; the ellipse becomes broader at each change of skin ; the edge is rough and broken by granulations.

**Cephalothorax.**—Rostrum blunt-pointed ; cephalothorax small, conical. Pseudo-stigmata dorsal; *pseudostigmatic organs setiform, serrated* spines. Interlamellar hairs similar ; rostral hairs short and simple.

**Legs** short, of about even thickness throughout ; joints rough and irregular in form. Each of the three central joints of the two front pairs of legs bears a

whorl of thin curved hairs, and there are a few similar hairs on the hind legs, chiefly on the outside. There are tactile hairs on all the legs, those of the anterior pairs being very long. The tarsi are clothed with long setiform hairs.

**Abdomen** elliptical ; notogaster flat, ventral surface arched, so that the notogaster stands much above the cephalothorax. The cast notogastral skins of the larva and nymph are carried flat on the back ; where the larval skin forms a central shield, and the nymphal skins almost concentric rings bordering it ; the centre of each skin, however, is usually a trifle in advance of the centre of that below it. The larval skin is arched and bordered by about seventeen thin, curved, sparsely-serrated, colourless spines, of which the hind one is central ; and this skin has three pairs of similar spines on the notogaster. Round the margin of each nymphal skin are about twenty chitinous, brown, more or less *conical papillæ* ; these gradually enlarge in size from the anterior to the posterior papillæ. Each papilla carries an *excessively long, slender* spine of clear chitin *sparsely* serrated. These may almost be considered as in a condition between spine and hair, the anterior (except the first pair) are mostly doubly-curved, and stiff, or nearly so, and are of similar form on the two sides of the abdomen ; those nearer the posterior extremity are more flexible and consequently vary more in form ; the first pair are flexible, but their curvature is usually equal on the two sides ; many of the spines are longer than the whole length of the body, and, as they stand out radially and border each cast skin, they give the creature a most extraordinary appearance. Some of the spines which project over the cephalothorax from the different skins cross, and make a series of bilateral figures, all different.

### *Larva.*

The appearance of this may be gathered from the above description of the cast notogastral skin. The

cephalothorax is similar to that of the nymph. The whole creature is almost colourless, slightly grey.

**Distribution.**—I have not ever found this larva or nymph, and cannot therefore say where it usually lives ; but in 1885 I bred four from a pair of adults which I kept in one of my cages, and I have since bred several from adults kept in a similar manner, and have also found a single cast skin of a nymph of this species on a piece of decayed wood at Gomshall in Surrey. The adult is rare. I reared the nymphs upon fungus growing on old wood.

#### FURTHER NOTES RELATIVE TO SPECIES DESCRIBED IN VOLUME I OF THIS BOOK.

*Oribata piriformis* (p. 238).—In the drawing of the nymph of this species, Pl. VI, fig. 2, and also in the description, the lamellar hairs are omitted ; they are large, setiform, and upright.

*Oribata setosa* (p. 243).—In the first volume of this book (p. 244) I called attention to the fact that the cusps of the lamellæ vary greatly in different specimens, and have since found, by examining large numbers of individuals, that the variety is even wider than I was then aware of ; every stage being found, from the very long pointed cusp nearly reaching the point of the rostrum to a tiny point just over the insertion of the lamellar hair, and, in these extreme instances, the shoulder below the lamellar hair is apt also to form a very small point ; thus since the publication of vol. i, I have received two specimens, one from Mr. E. Bostock and one from Mr. M. J. Michael, which have the cusps of the lamellæ truncated almost in the manner characteristic of *O. fuscipes*, yet they are not the same shape as the cusps in that species ; but the lamellar hair does seem to spring from the centre of the truncated

edge, instead of from its lower angle ; in other respects the specimens agree with *O. setosa*. In these exceptional cases the specimen may be distinguished from *O. fuscipes* by the short pseudo-stigmatic organs, those of *O. fuscipes* being long, by the general form and position of the cusps, the femora of the second pair of legs, &c.

Since the publication of vol. i, I have found *O. setosa* rather abundantly in an old thatched roof at the Land's End, Cornwall.

*Oribata quadricornuta* (p. 247).—The nymph often carries the cast notogastral skins of the larva and nymph, like a series of blunt conical bags, one more or less within the other, forming a conical pile on the back.

*Oribata punctata* (p. 253).—Berlese in his 'Acari, &c. Ital.,' fasc. iii, describes a species which he calls *O. Nicoletii*; it seems to me, however, to be only *O. punctata*. See also same work, Notes, fasc. iv, p. 52.

*O. punctata* has a comb-like hair upon the second tarsus not mentioned in the description in vol. i.

*Oribata cuspidata* (p. 260).—The rostral hairs in this species are serrated.

I here give a description of a nymph which I have figured in Pl. LIII, fig. 2. I had not discovered it when the first volume was published.

From this nymph, which I found in some numbers near Stone in Staffordshire, feeding on lichen in a cave, I bred an imago which I was not able to distinguish with any certainty from *Oribata cuspidata*; the imago was also tolerably abundant in the lichen. It will be seen that this nymph differs considerably from that from which I formerly bred the species (Pl. X, fig. 7). The mere difference of colour produced by greater transparency, allowing the colour of the alimentary canal and the food contained therein to be seen, might

well arise from altered circumstances; but the difference in the size and nature of the hairs, and of the pseudo-stigmatic organs, and many other details, can hardly be so explained. There is not any reason from analogy to suspect dimorphism in the nymph, and therefore it seems more probable that there may be two species, the imagos of which are extremely difficult to distinguish from one another.

**Colour** very slightly yellowish, almost colourless, highly transparent. The alimentary canal with its appendages and contents shows most distinctly through the dorsal surface, generally producing a colouring which is at once soft, brilliant, and varied; but it is entirely due to this cause.

**Texture** polished, but slightly reticulated, the reticulations, however, are so delicate and transparent, that I have not attempted to depict them in the plate, as doing so would, I fear, result in great exaggeration and an incorrect effect.

**Cephalothorax** nearly as broad as the abdomen where they meet, but divided from it by a slight sulcation. Rostrum curved, rather blunt, but pointed. Rostral hairs very dorsal, set far back, close together, slightly serrated. Palpi very conspicuous. Pseudo-stigmata rather dorsal. Pseudo-stigmatic organs short, pyriform. Interlamellar hairs long, curved, serrated.

**Legs** rather long, of about even thickness throughout. The two front pairs of femora are turned sharply inward, almost at right angles, at their proximal ends; genua rather long; tibiæ clavate; tarsi inversely pyriform, rather long. Tactile hairs on all legs, those of first pair very long; a whorl of curved, serrated hairs on each of the three central joints of each leg, and some fine hairs.

**Abdomen** pointed posteriorly, truncated anteriorly; arched; without markings except the before-named reticulations, but with a very long serrated hair on each antero-lateral angle; six or seven pairs of similar

hairs round the lateral and posterior margins ; two or three pairs of shorter, but otherwise similar hairs arising from the ventral surface and extending beyond the hind margin ; and two longitudinal rows each of about four or five similar hairs on the notogaster.

*Oribata avenifera* (p. 264).—Since the publication of vol. i of this book Berlese has described and figured in his 'Acari, &c. Ital.,' fasc. xxx, an *Oribata* which he calls *O. punctum* ; as far as I can judge from the plate and description, it appears to be identical with *O. avenifera*.

The tibiae of the second pair of legs in this species have projections like those of the fourth pair.

*Serrarius microcephalus* (p. 272).—Long subsequent to my pointing out the exceptional mandibles of this species and the necessity for creating a new genus to receive it and any similar forms, which genus I called "Serrarius," Prof. Berlese, who apparently had overlooked my paper on the subject and the first volume of this book, remarked the same thing, and founded a genus which he called *Neozetes* upon precisely the same species and characters ('Acari, &c. Ital.,' fasc. xx, March, 1885); he called his species *fusifer*, identifying it, for some reason which is not explained nor altogether apparent, with Koch's *Oribates fusifer* (Heft 31, fig. 3), and giving Nicolet's name of *microcephala* as a synonym ; he also gave another species of the genus, which he called *Neozetes bicomis*. In his notes to the same work, fasc. iii, p. 24, published in April, 1885 (the notes are separate fasciculi) Prof. Berlese states that Prof. Canestrini and I have described this species as *Leisoma microcephala*, which, in my own case, is perfectly true as regards my paper in the 'Journal of the Royal Microscopical Society' in March, 1879, but Prof. Berlese omits to state that in my paper in the same Journal in January, 1883, and again in the first volume of this book, I pointed out that it was not a

*Leisoma*, and gave details and drawings of the mandibles as a reason for creating the genus *Serrarius* to receive it.

*Cepheus latus* (p. 295).—Having found a larger number of specimens of this species since the publication of vol. i of this work, it has been noticed that there are two tolerably large rod-like hairs, one on each side, springing from the inner side of the lamella itself and slanting forward and upward; these may probably represent the interlamellar hairs, although the position would be very unusual.

*Scutovertex sculptus* (p. 299).—Berlese, in his ‘*Acari, &c. Ital.*,’ fasc. xxxv, N. 7, gives this species as a synonym of *Cepheus ovalis*, Koch, which he calls *Eremaeus ovalis*, and gives *Cepheus minutus*, Koch, as another synonym. I should almost fancy that there must be some accidental confusion in this, as *Cepheus ovalis*, Koch, does not appear to have any of the essential characteristics of the *Scutovertex*, and Berlese’s description and figure, although possibly more like *S. sculptus* than like Koch’s *C. ovalis*, are not either the one or the other if they be correct.

*Tegeocranus coriaceus* (p. 316).—Berlese’s *Carabodes coriaceus*, ‘*Acari, &c. Ital.*,’ fasc. xxxiii, is not Koch’s *coriaceus*, but is my *Tegeocranus marginatus*, a very different creature.

*Tegeocranus marginatus* (p. 322).—I find that there are interlamellar hairs in this species, but they are caducent, they are rod-like, and somewhat rough at the ends.

Inside the wrapper of fasc. xiv of ‘*Acari, &c. Ital.*,’ by Prof. Berlese, is stuck a small piece of paper, at the foot of which the words “*Acari novi, 1884,*” are engraved. On this paper are five rough sketches, one of which is called “*Carabodes asperulus;*” it may be intended for *Tegeocranus marginatus*.

## APPENDIX.

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### CLASSIFICATION.

Two works, each including a classification of the *Oribatidae*, have been issued since the publication of vol. i of this book; they are both Italian. The first is 'Prospecto dell' Acarofauna Italiana,' by Prof. Giovanni Canestrini, of the University of Padua, whose former classification, made in conjunction with Prof. Fanzago, will be found at page 55 of this book. The 'Prospecto' was published at Padua in 1885. The second is called 'Acarorum Systematis Specimen,' and is by Prof. Antonio Berlese, of the same University; it was published in the 'Bull. d. Soc. Entom. Ital.,' 1885, p. 125.

Prof. Canestrini's classification is as follows :

|    |                                                    |     |
|----|----------------------------------------------------|-----|
| 1. | Cephalothorax immobile on the abdomen.             | 2.  |
| 2. | ,,            mobile                        ,,     | 14. |
| 2. | ,,            furnished with a tectum              | 3.  |
| ,, | without                        ,,                  | 8.  |
| 3. | Abdomen furnished with wings                       | 4.  |
| ,, | without                        ,,                  | 5.  |
| 4. | Tectum with spatulate hairs . <i>Pelops</i> , K.   |     |
| ,, | hairs of other forms . <i>Oribates</i> , Latr.     |     |
| 5. | Tectum detached from cephalothorax                 | 6.  |
| ,, | partly fused with cephalothorax                    | 7.  |
| 6. | Tarsi heterodactyle . . . . <i>Leiosoma</i> , Nic. |     |
| ,, | homodactyle . . . . <i>Cepheus</i> , K.            |     |

|                                                                                                              |                            |
|--------------------------------------------------------------------------------------------------------------|----------------------------|
| 7. Tectum fused with the cephalothorax, from which only its large projecting wings remain separate . . . . . | <i>Oppia</i> , K.          |
| Tectum rudimentary, covering only the basal part of the cephalothorax .                                      | <i>Scutovertex</i> , Mich. |
| 8. The legs all tridactyle                                                                                   | 9.                         |
| " not "                                                                                                      | 11.                        |
| 9. Palpi not spinous . . . . .                                                                               | <i>Eremæus</i> , K.        |
| " spinous                                                                                                    | 10.                        |
| 10. Tarsi homodactyle . . . . .                                                                              | <i>Nothrus</i> , K.        |
| " heterodactyle . . . . .                                                                                    | <i>Damæus</i> , K.         |
| 11. Tarsi of the first pair of legs didactyle, of the others tridactyle . . . . .                            | <i>Nicoletiella</i> , Cn.  |
| Tarsi monodactyle                                                                                            | 12.                        |
| 12. Cephalothorax without apophyses or auricular crests . . . . .                                            | <i>Hermannia</i> , Nic.    |
| Cephalothorax with " "                                                                                       | 13.                        |
| 13. Legs longer than the body and nodose . . . . .                                                           | <i>Belba</i> , Heyd.       |
| Legs shorter than the body .                                                                                 | <i>Carabodes</i> , K.      |
| 14. Claws tridactyle . . . . .                                                                               | <i>Tritia</i> , Berl.      |
| " monodactyle . . . . .                                                                                      | <i>Hoplophora</i> , K.     |

Prof. Berlese's classification is as follows (it is printed *verbatim* from the original) :

#### FAMILIA.—ORIBATIDÆ.

*Vagantes, corpore clypeato, stigmis (sic) in cephalotoracis dorsu sculptis, setigeris.*

#### Sub-familia A — Tarsonemidæ.

*Abdominis dorsu in partes 5 diviso.*

+ Pedibus quarti paris ambulacris destitutis.

#### Genus 1. TARSONEMUS, Can. e. Fanz.

*Maris pedibus 4 paris incrassatis, fæminæ exilibus setigeris, antico nudo.*

*Genus 2. DISPARIPES, Mich.*

*Maris pedibus 4 paris incrassatis, fæminæ setigeris,  
antico clypeato* (Michaelii fide).

†† Pedibus æquilibus omnibus carunculatis.

*Genus 3.—PIGMEPHORUS, Kr.*

*Maris tarso antico crassiori chelato.*

**Sub-familia B.—Hoplophoridæ.**

*Antico cum abdomine articulato.*

*Genus 4.—HOPLOPHORA, K.*

*Scutis genitalibus 4, palpis quadriarticulatis, tarsis  
uniunguibus.*

*Genus 5.—TRITIA, Berl.*

*Scutis genitalibus 8, palpis quinquearticulatis, tarsis  
triunguibus.*

**Sub-familia C.—Nothridæ.**

*Tecto nullo, vel sub-nullo.*

† Genitalibus foramine ab ano sejuncto.

\* Unguicula pedum unica (Belbæ).

*Genus 6.—HERMANNIA, Nic.*

*Labio infero rhombeo, pedibus subgeniculatis, dermate  
granuloso.*

*Genus 7.—CARABODES, K.*

*Labio infero rectangulo, pedibus subgeniculatis, der-  
mate impresso, duro.*

*Genus 8.—BELBA, Heyd.*

*Labio infero subpentagono, antrorsus acuto, pedibus  
corpore multo longioribus, geniculatis, dermate glabro.*

\* Unguiculis pedum tribus (Eremæi).

*Genus 9.—DAMÆUS, K.*

*Corpore depresso, pedibus corpopre multo longioribus,  
geniculatis, dermate aspero.*

*Genus 10.—EREMÆUS, K.*

*Pedibus corpore curtoribus, labio infero semicirculari, dermate aspero.*

*Genus 11.—SCUTOVERTEX, Mich.*

*Scuto antico obsoleto, anticum non omnino tegenti* (Michaelii fide).

† Genitalium foramine ano approximato (Nothri).

\* Scutis larvarum persistentibus concentrice in dorso dispositis.

*Genus 12.—LIODES, Heyd.*

*Labio inferio duplice, frustulum rhombium sistenti, antico inermi, abdomine globoso, sub-orbiculari.*

\* Scutis larvarum caducis.

*Genus 13.—NOTHRUS, K.*

(a) Abdomine quadrangulo, depresso, excavato, antico anterius corniculato setigero, uncis pedum semper tribus, setis stigmaticis claviformibus.

(b) *Angelia*. Abdomine sub-trapezoideo, posterius rotundato excavato, antico inermi, uncis pedum 3, vel 2, vel 1, setis stigmaticis perlongis.

## Sub-familia D.—Oribatidæ.

*Tecto conspicuo, anticum tegenti.*

† Abdominis alis nullis (Leiosomi).

\* Mandibulis chelatis.

*Genus 14.—CEPHEUS, K.*

*Abdomine late orbiculari, tecto carinulas duas albocantes sistens; dermate aspero, labio late rectangulari.*

*Genus 15.—LEIOSOMA, Nic.*

*Abdomine obovato, glabro, nitido, tecto carinas duas laterales sistens, labio sub-trapezoideo, elongato.*

*Genus 16.—OPPIA, K.*

*Antico magno, pedibus ad latera abdominis insitis;*

*uncis setiformibus; labio semicirculari anterius rectilineo, abdome globoso, glabro.*

\* Mandibulis exertilibus, longis, serrulatis.

*Genus 17.—NEOZETES, Berl.*

†† *Abdominis alis conspicuis, pedes posticos tegentibus* (Oribates).

*Genus 18.—ORIBATES, Latr.*

*Antici pilis simplicibus, mandibulis curtis, crasse chelatis.*

(a) Appendicula tectiformi cephalothoraci omnino conjuncta (Oribates).

\* Uncis pedum tribus (Oribates alatus, Lucasii, agilis, latipes).

\*\* Unco pedum unico (O. dentatus).

(b) Appendicula tectiformi tantum basi cephalothoraci conjuncta, omnino anticum tegens et eccedens (Archipteria), (Oribates Nicoletii, nitens, &c.).

(c) Appendicula tectiformi tantum basi cephalothoraci conjuncta, partim obtegens, alis lateralibus laminiformibus (Sphærozetes).

\* Alæ anticæ tecti inter sese crista transversa conjunctæ (Orib. orbicularis, &c.).

\*\* Alæ laterales tecti inter sese discretæ (Orib. globosus).

*Genus 19.—PELOPS, K.*

*Antici pilis spathuliformibus vel foliiformibus, mandibulis basi latis denique strictioribus perlongis minuscule chelatis.*

Sub-familia E.—**Panopliidæ.**

*Stigmis incospicuis, pedibus triunguibus, anticis bivunguibus (an huius familie?).*

*Genus 20.—PANOPLIA, Heyd.*

*Corpore anterius quadricorni.*

In looking at these classifications it must be remembered that the two authors use the name *Oppia* for *Notaspis*,—*Damaeus* only for the tridactyle species of that genus,—*Belba* for the monodactyle species of the same genus (my reasons for considering this incorrect are given at p. 350); *Carabodes* for *Tegeocranus*,—*Tritia* for the tridactyle *Hoplophora*; and Berlese uses *Liodes* for *Nothrus theleproctus* (see, however, the remarks on that species), and *Neozetes* for *Serrarius* (see p. 581).

Both these classifications are based upon old anatomical errors, it is therefore scarcely worth while to discuss them. Prof. Canestrini's follows Nicolet's classification in most matters and retains the great reliance on monodactyle and tridactyle, and homodactyle and heterodactyle claws, which has already been fully dealt with in this book.

Prof. Berlese's somewhat complicated classification would I think be open to numerous objections, even if it were not rendered unserviceable by the anatomical errors alluded to above. The sub-family *Nothridæ* does not seem to me to be a happily combined group; I have already remarked on the sub-genus *Angelia* at p. 480. I cannot think that the numerous named sub-genera are convenient, nor the fact that the sub-family *Oribatidæ* has precisely the same name as the family. The mode of separating *Nothrus* from *Hermannia* has already been discussed at pp. 439, 480; the question of a two-clawed *Nothrus* at p. 491; and the separation of the monodactyle from the tridactyle species of *Damaeus* at p. 404.

It will be observed that in both classifications genera are inserted which I do not treat of in this book; the reason for not doing so is not that they are not British, for representatives of each genus are found here, but it is that I do not consider they belong to the family *Oribatidæ*. The first of these is the genus called *Nicoletiella* in Canestrini's and *Panoplia* in Berlese's classification; the latter author properly puts a ? as

to whether the genus belongs to the *Oribatidæ*. The known species of this remarkable genus are only two, one of which, *lutea*, is English. The creatures were first made known to acarologists by Canestrini and Fanzago in their 'Intorno agli Acari Italiani' (1877); the species described was not the British species, it was called *Nicoletia cornuta* and was included amongst the *Gamasidæ* between the genera *Gamasus* and *Sejus*. The description was short, and the figure did not enable either Dr. Kramer, of Schleusingen, or myself to recognise it; this probably may have been because, it being placed amongst the *Gamasidæ* without any note of the absence of the usual important Gamasid-characters, such as the respiratory organs, &c., we imported these family characters into the genus; a note is added that the species may possibly be the *Acarus denticulatus* of Schrank and Linnæus.

Heyden in 1828, in his classification referred to at p. 32 of this book, instituted the genus *Panoplia* for the *Acarus denticulatus* of Schrank, but without giving any description or reasons, and apparently without any acquaintance with the creature.

In 1879 Dr. Kramer published a careful and well-studied paper,\* in which, not recognising Canestrini's description, he treated the genus as new, and called it " *Labidostoma*." His was the English species " *luteum*." Dr. Kramer says that it is not one of the *Oribatidæ*, but does not say to what family it belongs.

In 1880 I published a short paper treating (*inter alia*) of the immature stages of this creature.† In this memoir I pointed out that the creature could not properly be included in any existing family, although it came nearest to the *Gamasidæ*.

In 1882 Dr. Riccardo Canestrini, of Padua, published

\* "Neue Acariden," 'Archiv für Naturg.,' xlv Jahrg., 1 Bd.

† "On two Species of Acarinæ believed not to have been before recorded as British," 'Journal of the Quckett Microscopical Club,' vol. vi, p. 107.

a treatise on the Italian species *Nicoletia cornuta*, in which he called the genus *Nicoletiella*.\*

In 1883 Prof. Berlese called the genus *Labilostoma*, Kramer, and immediately under it printed the species as *Nicoletiella lutea*.†

As Berlese, in his 'Acarorum Systematis Specimen,' has abandoned both these names and calls the genus *Panoplia*, I imagine that he considers that he has means of identifying Canestrini's *N. cornuta* with the *Acarus denticulatus* of Schrank and Linnaeus.

In 1882 Haller classed the creature at the end of the *Oribatidæ*, but inserted an explanation for doing so by stating that it is probably more like that family than like any other.‡

I confess it seems to me that transferring the genus from the *Gamasidæ* to the *Oribatidæ* is going from one error to another, as it is even less like the latter than the former family. The first pair of legs in the *Oribatidæ* are invariably true walking organs like the others; in *Nicoletia* (or *Nicoletiella*) they are tactile organs, as in *Cheyletus*, most *Gamasidæ*, &c., and are not used as legs. All known *Oribatidæ* have five joints to the leg, *Nicoletia* has seven. All known *Oribatidæ* have the same number of claws to each leg, and the number is always one or three;§ *Nicoletia* has a didactyle claw on the first leg and tridactyle on the others. Moreover, the style of claw is not similar. The respiratory system in *Nicoletia* is entirely different from that of the *Oribatidæ*, the mandibles are not contained in the camerastomum, as is invariably the case in the *Oribatidæ*, but are external organs, more like the Cheliceræ of Chelifers. *Nicoletia* is a swift, active creature, apparently predatory; the *Oribatidæ* are slow, and all

\* "Osservazioni sulla *Nicoletiella cornuta*," 'Atti Soc. Ven. Trent. di Sci. Nat.,' vol. viii, fasc. 1.

† 'Acarofauna Sicula,' p. 9.

‡ 'Beitrag zur Kenntniss der Milbenfauna Württembergs.'

§ Canestrini says that *Nothrus sylvestris* has didactyle claws, but I think it is an error; and, even if it were correct his description would only amount to saying that the small claw is abortive on one side (see the description of *Nothrus sylvestris* in this book, p. 490).

vegetable feeders; finally, *Nicoletia* does not look at all like one of the *Oribatidæ*.

The other genera constitute the group called *Tarsonemidæ* by these writers; it will be seen that Canestrini does not include this in the *Oribatidæ*; he has not yet reached it in his 'Prospetto dell' Acarofauna Italiana,' but in the earlier 'Intorno agli Acari Italiani' he treated it as a separate family, which seems to me correct, unless it be joined to one of the other small groups; it certainly does not appear that there are any grounds for classing it as a sub-family of the *Oribatidæ*. The idea did not first arise with Berlese; Haller appears to be responsible for it, as he puts *Pygmephorus*, Kramer, at the end of the *Oribatidæ*. Haller did not pay special attention to the *Oribatidæ*, and his reasons for including *Pygmephorus* therein were, firstly, the supposed presence of a tectum in each, which really does not exist nor even appear to exist in *Pygmephorus*; but there is some reason to suppose that Haller did not fully realise what Nicolet meant by a tectum; secondly, the presence of an organ bearing a resemblance to the pseudo-stigma and pseudo-stigmatic organ of the *Oribatidæ*; the existence of this organ (both in *Pygmephorus* and *Nicoletia*) appears to me to be the only argument of any importance for including them in the *Oribatidæ*, and when these organs were supposed to belong to the respiratory system, and to indicate its nature, it was apparently of value, but now that it has been ascertained that in the *Oribatidæ* they are not connected with that system and do not indicate its nature, it would indeed be slender grounds for including in that family creatures which in all other respects are entirely unlike; and even these organs, although having some resemblance to those of the *Oribatidæ*, are yet very different, and are not in a similar position.

The whole structure and organization of the *Tarsonemidæ* is quite different from that of the *Oribatidæ*; their life-histories and habits are also entirely different,

and in the *Tarsonemidæ* the sexes are so different from each other that no one would suppose them to belong to the same species, or, perhaps, even the same family, whereas in the *Oribatidæ* it is impossible to distinguish one sex from the other without seeing the internal reproductive organs.

In vol. i. (p. 60) I mentioned that I used the distinction of monodactyle and tridactyle claws with reluctance, fearing that later discoveries might invalidate it ; I only used it to a small extent. My fears have been justified by the discovery of some monodactyle species of *Nothrus*, &c. I have therefore thought it best to reduce the monodactyle and tridactyle distinction to a specific instead of a generic value as far as possible, even though the distinctions which take the place are not so convenient ; I, therefore, submit the following amended table for the identification of genera (to be used instead of that at page 64), in which I have eliminated the claw question in every case except that of *Tegeocranus*, where it is difficult to see what is to supply its place. I have also made a few other trifling alterations ; thus the genus *Hypothonius* is defined so as to include some species discovered since the publication of vol. i.

## ORIBATIDÆ.

*Amended Table for identification of Genera.*

|                                                                                                                                          |                                                                                                                                         |                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| Abdomen with chitinous, wing-like expansions. PTEROGASTERINÆ.                                                                            | Mandibles broad at base, suddenly becoming and continuing very slender and rod-like; chela small; interlamellar hairs usually statinate | PELOPS.                                               |
|                                                                                                                                          | Mandibles thick and stout, not slender nor rod-like in any part; interlamellar hairs usually setiform                                   | ORIBATA.                                              |
| Mandibles serrated and not chelate                                                                                                       |                                                                                                                                         | SERRABIUS.                                            |
| Last 3 pairs of legs inserted under the body                                                                                             | Cephalothorax and abdomen separated by an unbroken line                                                                                 | Lamellæ small, abdomen smooth.                        |
| With lamellæ                                                                                                                             |                                                                                                                                         | Lamella very large and light-coloured, abdomen rough. |
| Cephalothorax anchyllosed to abdomen.                                                                                                    | Ventral plate anchyllosed to dorsal                                                                                                     | Claws tridactyle                                      |
| Abdomen without chitinous wing-like expansions. APTERO-GASTERINÆ.                                                                        | Without lamellæ                                                                                                                         | Claws monodactyle                                     |
|                                                                                                                                          |                                                                                                                                         | Lamellæ joined by a central projection or otherwise   |
| Last 3 pairs of legs inserted at the edge of the body                                                                                    |                                                                                                                                         | ScutoverteX.                                          |
| Abdomen round or oval; notogaster arched; cuticle of adult fully chitinised                                                              | Legs thin and long, with clavate or moniliform joints                                                                                   | DAMEUS.                                               |
|                                                                                                                                          | Legs thick and short, with cylindrical joints                                                                                           | HERMANNIA.                                            |
| Abdomen oval, slightly pointed posteriorly; notogaster comparatively flat, undulated, with thin edges; cuticle of adult fully chitinised | Notogaster flat or hollow, or with a raised margin; cuticle of adult imperfectly chitinised                                             | EREMÆUS.                                              |
| Abdomen square, oblong, rhomboid, or shield-shaped; cuticle of adult without segmentation                                                | Abdomen without segmentation; Abdomen segmented                                                                                         | NOTIRUS.                                              |
|                                                                                                                                          |                                                                                                                                         | HYPOTHIONIUS.                                         |
| Cephalothorax hinged to abdomen, and folding down on its ventral surface. Ventral plate not anchylosed to dorsal                         |                                                                                                                                         | HOPLOPHORA.                                           |

## ANATOMY.

## THE INTERNAL ANATOMY OF THE NYMPHS.

The internal organization of the *Oribatidæ* during their immature stages in the main resembles that of the adults, and consequently there is but little to add here to the description already given of the more important inner organs of the latter in Chapter X (vol. i). There are, however, some very considerable points of difference, and others which, although of lesser value, are still worthy of notice.

To adopt the same order of dealing with the various systems as was adopted in the case of the adults :—

The **Alimentary Canal** consists of parts similar to those composing the canal of the imago, and the whole of the digestive organs are practically identical with those of the sexually mature creature. The nymphal stage, however, is essentially the period of growth, it is not surprising, therefore, that the organs connected with the procuring and absorption of food should take an even more prominent part in the organism during this time than in the later portion of life; accordingly we find the whole of the canal largely developed in the nymphs, forming by far the most important group of organs. There is but little to be said usefully respecting it, as the distinction from the adults consists in size, not in structure, and naturally the size varies considerably in different species; it may, however, be pointed out that the great cæca of the ventriculus are even larger, and more strongly developed in the nymphs than in the adults; and this would probably form an additional argument in favour of their glandular, or partly glandular, nature, as suggested in vol. i, because all, or almost all, of the glandular structures are strongly developed in the nymphs. Thus the preventricular glands, which really are modified anterior cæca of the ventriculus, and also

the super-coxal glands, are far larger in the nymphs than in the imagos of the corresponding species, while they have already attained the form and colour which characterises those of the adult.

Although the alimentary canal is so very similar in the earlier and later stages the mode of the attachment varies, as the canal of the nymphs is attached to the skin by several muscular and membranous bands not found in the adults. The reasons for this may possibly be twofold ; firstly, that the soft skin of the nymph does not afford the protection and firm points of anterior and posterior attachment supplied by the hard, chitinous integument of the adult ; and, secondly, that any support which the simple tracheæ of the adult in most genera are capable of giving is not available to the nymphs.

**The Reproductive System.**—The extent to which this is developed naturally depends greatly upon the age of the creature examined, but even in young specimens some rudiments of the female internal sexual organs may be found, while in the fully-grown nymphs the secretive portions will have attained a very considerable degree of formation although the protrusible organs more immediately connected with oviposition do not appear to be present. The structure of those parts that have been formed is, as might be anticipated, similar to that in the adult, only the parts are of smaller size and not yet functional ; thus, the central ovary is present, and of considerable size, and plainly shows the ova already formed, but without any sign of impregnation or cell-division in them. The oviducts and vagina are formed, but there is not any egg in either, and the former are small in diameter, and entirely without the chambers and the loop-like folds and turnings so conspicuous in the oviducts during the reproductive period of life. The oviducts lead into an unpaired vagina ; but I have not found the long extensible corrugated ovipositor which is usually such a very important organ of the adult female ; and I have not

been able to ascertain quite to my own satisfaction whether the vagina ends blindly or has an open end facing the genital plates ; I am inclined to think that the former is the correct view, at first at all events. This condition is shown at Pl. LIII, fig. 4. In the same manner with the nymph of the male, the testes and vesicula seminalis are apparently more or less formed, but I have not observed any intromittent organ, and the whole system is far smaller and more doubtful and difficult to trace than that of the female.

It may be remarked that the external genital plates are developed most distinctly in all the nymphs, but they are decidedly smaller than the corresponding plates of the adult ; and probably in the female would be too small to be functional ; of course they are not usually hard.

**Respiratory Organs.**—It is in this system that the greatest difference between the nymphs and larvæ, and the imagos exists ; and it is of a nature which possibly might not be anticipated, because in Insects a widely different, and even opposite, arrangement, usually occurs. Thus everyone who has dissected a silkworm, or, indeed, almost any Lepidopterous larva, knows well how very powerful and abundant the tracheæ are, far more so than in the imagos of the species ; but this does not in any way hold good with the larvæ and nymphs of the *Oribatidæ*. The whole tracheal system of the adult has been completely absent from every nymph and larva of the family which I have dissected, nor has its place been supplied by any other internal respiratory system whatever that I have been able to discover ; the breathing, or rather aeration of the blood, or peri-visceral fluids, appears to take place by the general body-surface, as in the *Tyroglyphidæ*, *Sarcoptidæ*, and other groups of the *Acarina*, which constitute the *Acari* proper of many authors. This, perhaps, is not to be wondered at when we remember that, although the adults of *Oribatidæ* have hard chitinous cuticles not in any way adapted to serve for the transmission of gases

to the internal fluids, yet the larvæ and nymphs almost always have soft skins, greatly resembling those of the *Tyroglyphidæ* and *Sarcoptidæ* in many species. It may also be suggested that if the aeration of the blood of the nymphs relied upon the action of a small number of tracheæ, having their stigmata in the acetabula of the legs, as in the adults, then, from the softer and more yielding nature of the parts in the immature creatures the stigmata might be very frequently closed, and consequently not be sufficient to admit the requisite quantity of air. It was, *inter alia*, this combination of the soft integument, and the absence of tracheæ, which caused Claparède to say that the *Oribatidæ* passed through an "Acarus-like form,"\*—a remark which was not surprising looking at the few species which he studied, but which he would probably have considerably modified if he had lived to extend his researches to a larger number. It is also the same characteristic, which is found in some other *Acarina* besides the *Oribatidæ*, which forced Dr. Kramer, in his classification (referred to in vol. i, p. 43), to base his main division of the *Acarina* into *Tracheata* and *Atracheata* entirely upon the Imagines.

It may be as well to repeat here that tracheæ are absent or almost absent in some genera of adults, principally those, such as *Nothrus*, which resemble the nymphs in some other respects.

It is interesting to observe that, although all trace of tracheæ or other internal respiratory organs is entirely absent from the larvæ and nymphs of the *Oribatidæ*, yet in every instance the organs which writers previous to myself have considered to be stigmata and which I call "pseudo-stigmata," are quite as strongly, or even more strongly, developed in these immature stages than in the adult, and are usually similar in character. This presence of these organs in the nymphs and larvæ, which is quite indisputable, being

\* "Studien an Acariden," 'Zeit. wiss. Zool.,' Bd. xviii (1868), pp. 515, 516.

very conspicuous, appears to me to be one of the most convincing arguments, beyond the actual facts of dissection, to prove that my view is correct that these structures are not stigmata but are sense organs, which are as requisite to the nymph and larva as to the adult.

#### LAMELLÆ OF THE ADULT.

Since the publication of vol. i I have received from Mr. M. J. Michael some specimens of a minute *Oribata* collected in Switzerland, and I believe unrecorded. In this species the coalescing of the inner edges of the large horizontal lamellæ, noticed at p. 123 of vol. i, as found in *O. quadricornuta*, *O. tecta*, *O. punctata*, &c., is not confined to the hinder parts of the lamellæ, as in those species, but is continued to the front, forming a flattish expansion, the anterior edge of which is rounded; and this resembles what Nicolet describes as a tectum in a far greater degree than anything which exists in any species mentioned in Nicolet's work does: indeed at first it might probably be considered as answering to a considerable part of his description; but that it is, after all, only a coalescing of the lamellæ is proved by the facts that there are not any upturned edges to the expansion, nor any other lamellæ, and that the lamellar hairs are on the flat of the expansion.

The species not being British I have not dealt with it in this book, but I have thought it well to mention the above facts.

#### THE MOUTH-ORGANS OF THE ADULT.

It has struck me in reading over Chapter IX of this work that the position of the less important mouth-organs is not made quite as clear as it might be, and that one of them, the epipharynx, is not mentioned.

The parts I refer to are, firstly, the ligula ; secondly, the lingua (or lingula) ; and, thirdly, the epipharynx. The first and second mentioned parts are very likely to be confused from the similarity of names, combined with considerable resemblance in position and form ; and possibly that danger is increased in this book by Pl. I, fig. 4, where the lingua (*g*) is intended to be seen through the labium and maxillæ from the (artificially produced) transparency of the latter organs ; but, in consequence of the lingua having been printed as a strong instead of a faint line, this effect is not produced. It is well, therefore, to make the matter as distinct as possible, and with that view I have given on Pl. LIII, figs. 5 to 8, some drawings or diagrams of the arrangement of the parts in question in *Cepheus latus*, a very good species for the purpose, which at the time of the publication of vol. i was far too rare to be used for dissecting purposes ; but I have found many more specimens of it since. These drawings and the descriptions here given will I hope render it easier to recognise the parts.

The **Ligula** is simply a chitinous piece forming a prolongation forward of the labium itself, and springing from the distal edge of the latter ; or, if "labium" be taken as a general name for the whole, then from the distal edge of the mentum it is usually more or less triangular ; in Insects it may be ankylosed to the mentum and divided from that part only by a sutural line, or may be attached by a ginglymous articulation ; it may also be a single azygous piece or divided longitudinally into two paired pieces, which when large are usually called "paraglossæ." In the *Oribatidæ* the ligula, when present at all, which is not usually the case, is, as far as I know, always ankylosed to the mentum, and only divided by a sutural line, and it is usually a paired organ, apparently serving partly to close the mouth-opening and to protect the lingua.

The **Lingua** (or **Lingula**) is described at p. 120 ; it is a delicate membranous organ arising from the inner

side of the back part of the labium, and its hinder edge practically curves round the *lower* portion of the entrance to the pharynx, into which it doubtless conveys the food. It is usually triangular or spoon-shaped, when taken as a single organ, and is strongly concave upward in transverse section. In some species the transverse bands of muscle which characterise the oesophagus are continued on the hind portion of the lingua.

The lingua really consists of two paired halves; it is not a single azygous organ, although the two halves generally meet at their inner edges and have that appearance. In prepared specimens the two halves generally separate, and become quite distinct from one another; each half then forms a more or less right-angled triangle, the straight sides being inward. In many species, *e. g.* *Cepheus latus*, each half of the lingua terminates anteriorly in two strong setæ or hooks (Pl. LIII, fig. 7), which curve upward, and it may be otherwise provided with hairs. The lingua is shown in Pl. LIII, figs. 5 and 6.

The **Epipharynx** is also a delicate, membranous, triangular or spoon-shaped organ; but it arises from around the *upper* edge of the pharynx, and stands straight outward into the mouth-cavity; where it forms a sort of hood overhanging the entrance to the pharynx; it is concave downward in transverse section, and appears not unlike the lingua turned upside down, although the two are not really of the same shape in any species that I have dissected. The epipharynx, in all instances known to me, is a single azygous piece, not two paired halves; and I have not seen it terminated by any setæ or hooks. It can usually only be seen in dissections; it is shown in Pl. LIII, figs. 5, 6, 8.

## THE REPRODUCTIVE ORGANS OF THE ADULT.

In the first volume of this work, at p. 162, I have stated that I had not then ever seen a pair of *Oribatidæ* in the act of coition. I have not been more successful since that time, although I have kept large numbers in confinement, and have very frequently bred young, and have observed the parents carefully. I have, however, ascertained one fact from which the mode of impregnation may be more or less surmised with probability of correctness ; this fact is that there is in the female an almost straight, extremely delicate, membranous tube, starting from within the anal plates, and leading direct to the central ovary. The tube arises close above the chitinous piece which lies at the anterior end of the anal opening and serves to prevent the plates from being drawn within the body and also serves as an attachment for muscles. A somewhat diagrammatic representation of this tube in *Notaspis lucorum* is given on Pl. LIII, fig. 10. It has been ascertained by Haller,\* Nalepa,† and myself‡ (the two last papers being since the publication of vol. i of this work) that in the *Tyroglyphidæ* a sperm-duct, almost similar to that above described but more distinct, leads from a bursa copulatrix close to the anus to the ovary of the female. It is true that in the *Tyroglyphidæ* a receptaculum seminis is interposed in the course of the duct which I have not found in the *Oribatidæ*. With regard to the bursa copulatrix being situated close to the anus, see also the observations by myself and others as to *Glyciphagus* (a genus of *Tyroglyphidæ*), *Dermaleichus*, &c., quoted in vol. i, p. 163.

\* "Zur Kenntniss der Tyroglyphen und Verwandten," 'Zeitschr. f. wiss. Zool.,' Bd. xxxiv, p. 288.

† "Die Anatomie der Tyroglyphen," 'Sitzgsber. der k. Akad. der Wissensch. Wien,' Bd. xc, Abth. 1, p. 97 (1884); *ibid.*, Bd. xci, Abth. 1, p. 116 (1885).

‡ "On some undescribed Acari of the Genus *Glyciphagus* found in Moles' Nests," 'Journ. Linn. Soc. London,' Zool., vol. xix, p. 273.

From the above facts I think that we may fairly conclude that in the *Oribatidæ* coition probably takes place by a bursa copularix within the anal plates and in immediate proximity to the anus, and not at the vulva of parturition within the genital plates.

### THE HEART IN ACARINA.

In vol. i, at p. 181, I drew attention to Dr. Kramer's observation on the heart in *Gamasus*, as being, I believed, the only instance where any acarologist or anatomist had published any account of the existence of such an organ in the *Acarina*. Since vol. i was issued, this organ has been re-discovered by Herr Willibald Winkler. Prof. Claus and Herr Winkler, not knowing of Kramer's paper, stated the discovery as being new, and it naturally attracted considerable attention;\* subsequently, however, they fully acknowledged Dr. Kramer's priority.† Winkler succeeded in making more exact observations than Kramer had done; he describes the heart as very delicate, composed of a single chamber, and as having two paired ostia on the dorsal side and an aorta running straight forward in the median line and terminating with an open end above the brain. Winkler discovered a similar organ in *Ixodes*; and, in the first notice, it was suggested that it might probably be found in all *Acarina*. I have not, however, heard that anyone has, up to the present time, succeeded in finding it in any other family. Since the appearance of Winkler's paper, and with the assistance that it affords, I have carefully searched for the organ in living specimens of young larvæ and nymphs of *Oribatidæ*, and in adults which had just emerged and were still transparent. This was Winkler's mode of observation, he was not able to find the organ in dissections or sections. My

\* "Ueber das von Willib. Winkler aufgefundene Herz der Gamasiden," 'Anz. Ak. d. Wiss. Wien,' Dec., 1885, pp. 250—253.

† "Das Herz der Acariden," 'Arbeit. d. Zool. Inst. zu Wien,' Band vii, Heft 1.

search has hitherto been completely unsuccessful. I have not observed any pulsating organ whatever.

When we consider the very rudimentary state of the organ in the *Gamasidæ*, and the extreme activity of that family of *Acarina*, it is not improbable that it may be absent altogether or quite rudimentary, in such lethargic creatures as the *Oribatidæ*.

### THE NERVOUS SYSTEM.

In vol. i, at p. 184, it was mentioned that I had not then been able to trace the nervous system of the *Oribatidæ* except so far as regarded the great supra-oesophageal ganglion, the so-called brain; nor have I been much more successful since. I have found the nerves of these minute and inactive creatures very difficult to demonstrate with any certainty, and I have not succeeded in finding any stain or reagent which will differentiate them from the surrounding tissues. One observation may be worthy of record. I have satisfied myself that in *Oribata globula* a chain of at least three small roundish ganglia, joined to the supra-oesophageal ganglion and to each other by fine commissures of moderate length, runs from each side of the supra-oesophageal ganglion; and is directed toward the side of the body and then downward and backward; the first is smaller than the second. This chain is represented, somewhat diagrammatically, on Pl. LIII, fig. 11.

I have observed similar ganglia in *Pelops* but did not succeed in detaching them so as to trace the commissures.

I have also ascertained that a nerve does run to the inner end of the pseudo-stigmatic organ (Pl. XLVIIA, fig. 8), but I cannot say whence it comes.

## THE FINAL CHANGE FROM NYMPH TO IMAGO.

In vol. i of this work, at pp. 85, 86, it has been pointed out that considerable differences of opinion had existed between acarologists as to whether the whole substance of the nymph of one of the *Acarina* (except the skin) dissolved and became plastic prior to the formation of the adult, which was subsequently developed from the general body-substance; or whether the dissolution was at most only partial, the greater part of the organs remaining intact, and the process more resembling a mere change of skin. I mentioned that in the case of the *Oribatidæ* I was inclined to the former view, which was that held by Mégnin and others. Since the publication of vol. i a considerable doubt has arisen in my mind as to whether the dissolving process was always complete; and I have therefore endeavoured to ascertain whether any light could be thrown upon the question by obtaining very transparent nymphs, which had highly coloured and conspicuous internal organs, and watching them frequently during the change. The species which I selected for observation were *Notaspis bipilis* and *Notaspis lucorum*; these were selected because their nymphs have smooth, colourless, and highly transparent cuticles, but have the alimentary canal and its glandular and other appendages strongly coloured and conspicuous; moreover they are common species.

Each creature to be observed was placed in a separate glass cell without any other *Acarina*, and each cell was numbered so as to avoid any possibility of mistake; only a very small number of specimens were observed during the same period, fresh specimens not being started until the old ones had emerged or died; this was in order that the exact appearance of each specimen should be remembered from one inspection to the next. The distances of the more conspicuous internal organs, such as the preventricular glands,

from the rostrum and progaster of the nymphal skin were measured from day to day with an eye-piece micrometer. The investigation was not easy; because in order to see with sufficient clearness it was necessary to use transmitted light and this prevented my covering the whole bottom of the inside of the cell with blotting-paper, which is my usual mode of preserving the desired hydrometric condition; from this cause a larger proportion of the specimens died than has been usual in other cases of rearing the nymphs as mentioned in this book.

The results were not altogether satisfactory, being somewhat contradictory in the two species, but yet perhaps they will be considered of sufficient interest to be worth recording. The general conclusions come to, so far as I was able to arrive at any, were:

Firstly, that it is not the fact that in every species and in every instance there is a complete breaking-up and dissolution of all the organs of the nymph prior to the formation of the adult; but that, on the contrary, in some cases at all events, some of the internal organs of the nymph are transferred to the adult and are not dissolved but are identical in both stages.

Secondly, that where dissolution and reformation have occurred in the specimens which I have observed the two processes have gone on simultaneously, and there has not been any time when the cuticle contained plastic or liquid matter only without any organs.

Thirdly, that in the earlier stages of the change the contents of the nymphal skin have (in the observed instances) shrunk backward toward the posterior portion of the creature, leaving the cuticle of the rostrum, &c., empty, and that the contents of the legs have been withdrawn or shrunk inward into the body-substance, leaving the cuticle of the legs empty.

Fourthly, that in the later stages of formation the organs of the adult have again advanced forward nearer to the rostrum of the nymphal cuticle, but not as far forward as the old organs originally were.

It should be mentioned that since the publication of vol. i Dr. Nalepa, of Vienna, as the result of a careful study of the development of the creature called *Trichodactylus anonymus* by Berlese, which is one of the *Tyroglyphidæ* (Berlese's *Trichodactylus* not being identical with Dufour's earlier genus of the same name, although founded upon it), denies the correctness of Mégnin's view as to the entire dissolution of the creature.\*

I have not thought it worth while recording the details of the observations made on each specimen, but have selected two typical cases; the records of a larger number would not have introduced any new facts. I should have continued the observations upon other species had time allowed, but as far as this book is concerned they were cut short by the necessity of publishing vol. ii.

#### NOTASPIS BIPILIS.

April 10th, 1887.—Placed a nymph, lately become inert, in a separate cell.

11th and 12th.—The contents of the body are shrinking backward toward the hinder end, leaving the cuticle of the rostrum empty; the muscles of the legs and of the mandibles are shrinking inward and being withdrawn into the body-substance.

13th and 14th.—The cuticle of the rostrum and legs is now empty; signs of the formation of new muscles may be seen.

15th.—The new legs may now be seen forming, not within the old legs; the new muscles to the mandibles may also be traced, no change has yet taken place in the alimentary canal (which is highly coloured) except its shrinking backward.

17th.—The colon has broken away from the ventriculus but remains attached to the rectum. The

\* "Die Anatomie der Tyroglyphen," ii Abtheil., 'Sitzb. k. Akad. d. Wiss.,' Wien, 1885, pp. 150—156.

lamellæ and lamellar hairs of the adult may now be distinctly seen.

18th.—A great change has taken place in the alimentary canal ; the old ventriculus is enormously distended and globular ; there seems to be a small fracture at the top of it, the cæca are vague and almost hidden below the ventriculus. The preventricular glands are now small and much lower down than the top of the distended ventriculus. The new pseudo-stigmatic organs (of the adult) are now plainly seen, they are further back than the coxæ of the fourth legs of the nymphal skin. The formation of the muscles running to the new legs is apparent.

19th.—The old ventriculus has again enlarged slightly.

21st.—The ventriculus has become shorter and wider ; a considerable amount of light brownish matter has collected along its anterior edge.

22nd.—Scarcely any change. The nymphal skin shows more prismatic colour by reflected light, and the organs of the new cephalothorax are less distinctly seen, as if there were air between the old and new skins. The muscles at the sides are becoming more complete.

23rd.—The old ventriculus is lessening and travelling more forward.

24th.—The same process is continuing.

25th.—The cæca have become larger and rounder ; a new colon may now be seen forming inside the débris of the old one.

26th.—The ventriculus, &c., continue to travel forward, a new rectum may just be seen.

27th.—The alimentary canal continues to travel forward, the old ventriculus has a concave hind margin ; the old colon has nearly disappeared.

30th.—The old colon has entirely broken up and gone ; the new rectum is quite distinct.

May 1st.—The alimentary canal has travelled forward until the preventricular glands nearly touch the

progaster of the nymphal skin. The posterior end of the old ventriculus is turned slightly upward. The new colon has enlarged and is evidently attached either to a new ventriculus below the old one or to the under part of the old ventriculus itself.

2nd.—The old ventriculus gets shorter and wider; the muscles to the new coxae have become very conspicuous.

4th.—The old ventriculus seems breaking up, particularly on the left side.

6th.—The old ventriculus continues to break up; its cæca have become detached.

7th.—The old alimentary canal has broken up altogether.

9th.—The adult has emerged; it does not contain any sign of the old highly-coloured alimentary canal or appendages; the new canal is very large but entirely colourless. (This is not a question of the contents of the canal but of local colour and external coating of so-called liver-cells.)

#### NOTASPIS LUCORUM.

April 28th, 1887.—Placed a nymph which had just become inert in a separate cell.

30th.—No change as yet.

May 1st.—The whole alimentary canal and internal organs are travelling backward; the skin of the rostrum and legs appears empty.

2nd.—No change to be seen.

4th.—The clear sarcode appears somewhat striated longitudinally. The alimentary canal, &c., have travelled very far back.

6th.—The pseudo-stigmatic organs of the adult may be plainly seen; the canal, &c., are still very far back.

7th.—The adult emerged; apparently with the same alimentary canal and its appendages as the nymph had possessed, having the same high coloration and form, and, as far as I could judge, absolutely identical.

## FOREIGN SPECIES OF ORIBATIDÆ

NOT HITHERTO FOUND IN ENGLAND.

THE subjoined list will, I hope, be useful in case any student using this book should find species not known to be British at the date of publication, and consequently not included in this work ; it comprises all species which have, to my knowledge, been recorded as captured abroad, and which have not, as far as I know, been captured in Britain.

The genera are placed in alphabetical order, and the species in each genus are arranged in a similar manner.

In each case reference is given to the description by the original discoverer ; but in cases where he has published a fuller description, or one in a more accessible work, at a later date, the second reference is often given instead of the first ; where the discoverer's description or drawings are imperfect and a fuller or different description or plate is given by a later author references are usually given to both.

The references are somewhat abbreviated, but the full titles of the respective books and papers will be found in the bibliography ; see also p. 200.

The species are always inserted in the genus assigned to them by their discoverer, although this may be incorrect or not consonant with present classifications ; where it is practically certain that the genus given is misleading a note to that effect is usually added.

In almost all cases a short note of what appear to be the most striking characteristics of the species is added.

It must be remembered that this list is taken only

from the published descriptions and plates, many of which are extremely imperfect and even erroneous. In most cases there are not any existing types which can be referred to ; if it were possible to do so, it would probably be found that many of the so-called species were synonyms of one another, or even of species described in this work as British, or were based upon immature forms.

| Name.                        | Characters.                                                                                                                                                                      | Reference.                                                                        |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| <i>Belba bicostata</i> ..... | The same as <i>Damæus bicostatus</i> , Koch                                                                                                                                      | Can. e Fan., p. 35.                                                               |
| — <i>denticulata</i> ...     | Abdomen bearing long soft hairs                                                                                                                                                  | G. Canestrini, Prosp. Acarof. Ital., p. 40.                                       |
| — <i>Dugesii</i> .....       | Abdomen discoidal, concave (not drawn discoidal by Berlese)                                                                                                                      | Can. e Fan., p. 33, tav. 1, fig. 3; Berlese, Acari, &c. Ital., fasc. iii, tav. 6. |
| — <i>gibba</i> .....         | Abdomen with a distinct lump in front; pseudostigmatic organs thickened at the distal ends                                                                                       | Can. e Fan., p. 36.                                                               |
| — <i>globipes</i> .....      | Like <i>Damæus verticillipes</i> , but hairs on abdomen stronger (see description of <i>D. verticillipes</i> , p. 414)                                                           | Berlese, Acari, &c. Ital., fasc. xxxiii, tav. 4.                                  |
| — <i>Troisii</i> .....       | Very long-shaped; between <i>Damæus</i> and <i>Nothaspis</i> . Hairs on abdomen long and soft                                                                                    | Berlese, Acari, &c. Ital., fasc. iii, tav. 5.                                     |
| <i>Carabodes cephalotes</i>  | Long-shaped; probably a <i>Tegeocranus</i> , but not <i>elongatus</i>                                                                                                            | Koch, Heft 3, fig. 16.                                                            |
| — <i>cynocephalus</i>        | See <i>Nothrus</i> (p. 614)                                                                                                                                                      |                                                                                   |
| <i>Celæno ægrotæ</i> .....   | Not one of the Oribatidæ, probably a <i>Trachynotus</i> (it is found in England). Berlese adopts the genus <i>Celæno</i> for it, transferring that genus to the <i>Gamasidae</i> | Koch, Heft 3, fig. 5.                                                             |
| — <i>coccinea</i> .....      | A red octagonal nymph                                                                                                                                                            | Koch, Heft 32, fig. 1.                                                            |
| — <i>obsoleta</i> .....      | A nymph, colour whitish                                                                                                                                                          | Koch, Heft 32, fig. 4.                                                            |
| — <i>rhodomela</i> ...       | Like <i>C. coccinea</i> , but with black spots                                                                                                                                   | Koch, Heft 32, fig. 2.                                                            |

| Name.                        | Characters.                                                                                                                                                                                               | Reference.                                                                                                          |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <i>Cepheus minutus</i> ..... | Supposed by Berlese to be a <i>Scutovertex</i> , or, as he calls it, an <i>Eremæus</i>                                                                                                                    | Koch, Heft 3, fig. 12; Can. e Fan., p. 20; Berlese, Acari, &c. Ital., fasc. xxxv, tav. 7?                           |
| — <i>ovalis</i> .....        | Probably a <i>Notaspis</i> ; supposed by Berlese, apparently incorrectly, to be identical with <i>Cepheus minutus</i> , Koch                                                                              | Koch, Heft 32, fig. 7; Can. e Fan., p. 18.                                                                          |
| <i>Damæus bicostatus</i> ... | With two longitudinal furrows on the notogaster, but no hairs                                                                                                                                             | Koch, Heft 2, fig. 12; G. Canestrini, Prosp. Acarof. Ital., p. 33; Berlese, Acari, &c. Ital., fasc. xxxiii, tav. 5. |
| — <i>craterifer</i> ...      | Rostrum blunt. The abdomen has what are probably cast nymphal skins; it is very complicated, with radiating lines and broad wing-like processes. Berlese says that this species is his <i>Belba gibba</i> | Haller, Beschreibung einiger neuen Milben, p. 227.                                                                  |
| — <i>Dugesii</i> .....       | The same as <i>Belba Dugesii</i> , Can. e Fan.                                                                                                                                                            | G. Canestrini, Prosp. Acarof. Ital., p. 33, &c.                                                                     |
| — <i>femoratus</i> ...       | With a raised margin to the abdomen; no hairs on notogaster                                                                                                                                               | Koch, Heft 30, fig. 7.                                                                                              |
| — <i>onustus</i> .....       | Large, carrying quantities of extraneous material on the back in a mass                                                                                                                                   | Koch, Heft 38, fig. 7.                                                                                              |
| — <i>papillipes</i> ...      | Very like <i>D. verticillipes</i>                                                                                                                                                                         | Nic., 463.                                                                                                          |
| — <i>setosus</i> .....       | Carrying cast skins, a projection at hind margin with four tubercles                                                                                                                                      | Berlese, Sopra due nuove gen., &c., p. 51; G. Canestrini, Prosp. Acarof. Ital., p. 34.                              |
| <i>Eremæus asperulus</i> ... | Probably <i>Damæus bicostatus</i> , Koch                                                                                                                                                                  | Berlese, Acari, &c. Ital., sp. nov., ser. i.                                                                        |
| — <i>hepaticus</i> ...       | A <i>Notaspis</i> , like <i>N. oblongus</i>                                                                                                                                                               | Koch, Heft 3, fig. 23; Berlese, Acari, &c. Ital., fasc. xv, tav. 9.                                                 |
| — <i>leporosus</i> ...       | An American species. Abdomen round, flat, dotted, with fine hairs; pseudo-stigmatic organs long, setiform, serrated                                                                                       | Haller, Beschreib. einiger neuen Milben, p. 225.                                                                    |
| — <i>lineatus</i> ...        | Possibly a <i>Notaspis</i>                                                                                                                                                                                | Thörell, Arach. fr. Spetsbergen, &c., p. 646.                                                                       |

| Name.                         | Characters.                                                                                                                                                           | Reference.                                                                                                       |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| <i>Eremæus ovalis</i> .....   | With oblique ridges on abdomen, rather like a <i>Scutovertex</i> ; stated, erroneously, to be <i>Cepheus ovalis</i> , Koch, and <i>Scutovertex sculptus</i> , Michael | Berlese, Acari, &c. Ital., fasc. xxxv, tav. 7.                                                                   |
| — <i>siculus</i>              | A variety of the last species; ridges on abdomen wavy, not oblique                                                                                                    | Berlese, Acari, &c. Ital., fasc. xxxv, tav. 8.                                                                   |
| — <i>setosus</i> .....        | The same as <i>Damæus setosus</i> , Berlese                                                                                                                           | Berlese, Acari, &c. Ital., sp. nov., ser. i —xi.                                                                 |
| — <i>tibialis</i> .....       | Notogaster concave, granulated, not reticulated; two small lumps in its median line                                                                                   | Nic., p. 452.                                                                                                    |
| <i>Hermannia granulata</i>    | Very like <i>H. arrecta</i>                                                                                                                                           | Nic., p. 469.                                                                                                    |
| <i>Hoplophora arctata</i> ... | Probably <i>H. longula</i> , Koch; said to feed on <i>Phylloxera</i>                                                                                                  | Riley, 6th Missouri Rep.; also Trans. Acad. Sci. St. Louis, vol. iii, N. 2, p. 216.                              |
| — <i>carinata</i>             | With a median longitudinal carina on abdomen                                                                                                                          | Koch, Heft 32, fig. 9; Berlese, Acari, &c. Ital., fasc. xxxvi, tav. 1.                                           |
| — <i>— pulcherrima</i>        | With carinæ on aspis and notogaster, and a projection from the progaster as in <i>H. anomyla</i> ; deeply areolated                                                   | Berlese, Acari, &c. Ital., fasc. xxxv, tav. 10.                                                                  |
| — <i>crinita</i> ...          | Possibly the same as <i>H. globosa</i> , Koch                                                                                                                         | Koch, Heft 32, fig. 8.                                                                                           |
| — <i>ferruginea</i>           | With conspicuous pseudo-stigmatic organs                                                                                                                              | Koch, Heft 32, fig. 10.                                                                                          |
| — <i>globosa</i> ...          | Globular, with two light spots on aspis                                                                                                                               | Koch, Heft 32, fig. 12; G. Canestrini, Prosp. Acarof. Ital., p. 46; Berlese, Acari, &c. Ital., fasc. vi, tav. 3. |
| — <i>lævigata</i> .           | Like <i>H. globosa</i> , Koch, but no hairs on abdomen                                                                                                                | Koch, Heft 38, fig. 16.                                                                                          |
| — <i>longula</i> ...          | Very long and narrow, with conspicuous pseudo-stigmatic organs                                                                                                        | Koch, Heft 32, fig. 17.                                                                                          |
| — <i>straminea</i>            | Very light, almost hairless.                                                                                                                                          | Koch, Heft 32, fig. 13; Can. e Fan., p. 37.                                                                      |
| — <i>testudinea</i>           | Pointed posteriorly. Qy identical with <i>H. ardua</i> ?                                                                                                              | Koch, Heft 32, fig. 11.                                                                                          |
| <i>Leisoma coracinum</i> ...  | Same as <i>Oribats coracinus</i> , Koch                                                                                                                               | Berlese, Acari, &c. Ital., fasc. xx, tav. 3.                                                                     |

| Name.                             | Characters.                                                                                                                                                                                  | Reference.                                                                                          |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| <i>Leiosoma fusifer</i> .....     | The same as <i>Oribates fusifer</i> , Koch; incorrectly stated to be identical with <i>Serrarius microcephalus</i>                                                                           | G. Canestrini, Prosp. Acarof. Ital., p. 23.                                                         |
| — <i>globosum</i> ...             | The same as <i>Oribates globosus</i> , Koch                                                                                                                                                  | Berlese, Acari, &c. Ital., fasc. xx, tav. 4.                                                        |
| — <i>lativentris</i> ...          | Abdomen short and wide; progaster very strongly undulated                                                                                                                                    | Nic., p. 444.                                                                                       |
| — <i>marginata</i> ...            | Abdomen with a lateral sulation forming a border                                                                                                                                             | Nic., p. 442.                                                                                       |
| — <i>nitens</i> .....             | Progaster rounded                                                                                                                                                                            | Nic., p. 441.                                                                                       |
| <i>Leptorchristis micronychus</i> | A genus and species instituted for a creature with fourth legs adapted for jumping and two small projections from the front edge of the dorso-vertex; genital and anal plates close together | Berlese, Nota intorno a due Acari poco conosciuti, Atti Soc. Ven. Trent., vol. ix, fasc. ii (1885). |
| <i>Michaelia paradoxa</i> .       | An exceptional creature, nearer to <i>Hoplophora</i> than to any other genus, but not closing up; covered with leaf-shaped hairs                                                             | Haller, Beschreibung einiger neuen Milben, p. 229.                                                  |
| <i>Murcia acaroides</i> ...       | A nymph                                                                                                                                                                                      | Koch, Heft 3, fig. 22.                                                                              |
| — <i>ephippiata</i> ...           | A nymph (dark)                                                                                                                                                                               | Koch, Heft 31, fig. 22.                                                                             |
| — <i>fumigata</i> .....           | A nymph (dark)                                                                                                                                                                               | Koch, Heft 31, fig. 21.                                                                             |
| — <i>obsoleta</i> .....           | A nymph (light). Seep. 374                                                                                                                                                                   | Koch, Heft 31, fig. 23.                                                                             |
| <i>Neozetes bicornis</i> * ...    | The same as <i>Serrarius microcephalus</i> . (Published long after the publication of <i>Serrarius</i> )                                                                                     | Berlese, Acari, &c. Ital., fasc. xx, tav. 7.                                                        |
| — <i>fusifer</i> .....            | Said to be the same as <i>Oribates fusifer</i> , Koch, and said, erroneously, to be the same as <i>Serrarius microcephala</i>                                                                | Berlese, Acari, &c. Ital., fasc. xx, tav. 6.                                                        |
| <i>Notaspis castaneus</i> ...     | A <i>Notaspis</i> ; species not distinguishable                                                                                                                                              | Hermann, p. 89.                                                                                     |
| — <i>corynopus</i> ...            | A <i>Notaspis</i> ; species not distinguishable                                                                                                                                              | Hermann, p. 89.                                                                                     |
| — <i>humeralis</i> ...            | An <i>Oribata</i>                                                                                                                                                                            | Hermann, p. 92.                                                                                     |
| <i>Nothrus ansatus</i> .....      | Said to be of the nature of <i>N. echinatus</i> , Koch                                                                                                                                       | Haupt, Käfermilben um Bamberg.                                                                      |
| — <i>biciliatus</i> ...           | Somewhat like <i>N. sylvestris</i> , but with two rows of clavate hairs round abdomen. See <i>N. sylvestris</i> , p. 491                                                                     | Koch, Heft 38, fig. 2; Can. e Fan., p. 23.                                                          |

\* This species is British.

| Name.                        | Characters.                                                                                                                                       | Reference.                                                                              |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| <i>Nothrus bicolor</i> ..... | A nymph, rather like that of <i>Notaspis lacustris</i> , but found under moss in woods                                                            | Koch, Heft 38, fig. 5.                                                                  |
| — <i>bicristatus</i> .       | Something like <i>H. peltifer</i> , Koch                                                                                                          | Haupt, Käfermilben um Bamberg                                                           |
| — <i>bispinosus</i> ...      | A nymph something like that of <i>N. horridus</i>                                                                                                 | Koch, Heft 29, fig. 24.                                                                 |
| — <i>bistriatus</i> ...      | One of the <i>N. horridus</i> group                                                                                                               | Koch, Heft 29, fig. 21.                                                                 |
| — <i>borealis</i> .....      | Possibly identical with <i>N. horridus</i>                                                                                                        | Thörell, Arach. fr. Spetsbergen, &c., p. 697.                                           |
| — <i>canaliculatus</i>       | Found in material dragged out of water; abdomen with a margin; probably a <i>Tegeocranus</i>                                                      | Koch, Heft 29, fig. 7; and Uebersicht, Heft 3, p. 107, <i>Carabodes canaliculatus</i> . |
| — <i>concavus</i> ...        | Said to be of the nature of <i>N. echinatus</i> , Koch. Qy. Is it <i>N. spiniger</i> ?                                                            | Haupt., Käfermilben um Bamberg.                                                         |
| — <i>cynocephalus</i>        | Very small, probably a <i>Tegeocranus</i> , not unlike <i>Carabodes cephalotes</i> , Koch                                                         | Koch, Heft 30, fig. 8; and Uebersicht, Heft 3, p. 107, <i>Carabodes cynocephalus</i> .  |
| — <i>dimera</i> .....        | Said to be of the nature of <i>N. theleproctus</i> and <i>N. scaliger</i> , but with two very long hairs at the end of abdomen. Qy. Is it mature? | Haupt, Käfermilben um Bamberg.                                                          |
| — <i>doliaris</i> .....      | A nymph                                                                                                                                           | Koch, Heft 29, figs. 5 and 6.                                                           |
| — <i>dorsatus</i> ...        | Large, elliptical; a smooth oval space on the hind part of the notogaster; pseudo-stigmatic organs short and clavate                              | Can. e Fan., p. 31.                                                                     |
| — <i>echinatus</i> ...       | Between <i>N. spiniger</i> and <i>N. segnis</i>                                                                                                   | Koch, Heft 2, fig. 17.                                                                  |
| — <i>ellipticus</i> ...      | Said to be like <i>N. theleproctus</i> , but abdomen rounded behind, instead of projecting between the hairs; probably immature                   | Haupt, Käfermilben um Bamberg.                                                          |
| — <i>gibbus</i> .....        | A <i>Hermannia</i> , somewhat like <i>H. nodosa</i> , but with long filiform pseudo-stigmatic organs                                              | Koch, Heft 29, fig. 4.                                                                  |
| — <i>minimus</i> ...         | Very small; grey; probably a nymph                                                                                                                | Koch, Heft 38, fig. 1.                                                                  |

| Name.                                                    | Characters.                                                                                                                        | Reference.                                           |
|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| <i>Nothrus ovivorus</i> ...                              | Probably a <i>Notaspis</i> ; supposed to have been found sucking the eggs of the canker-worm                                       | Packard, A. S., Jr.                                  |
| — <i>ovulum</i> .....                                    | Probably a <i>Hermannia</i> or <i>Tegeocranus</i> ; said to be very like Koch's <i>Nothrus gibbus</i> , but only about 25 mm. long | Haupt., Käfermilben um Bamberg.                      |
| — <i>peltifer</i> .....                                  | Like <i>N. theleproctus</i> , but with hairs round the abdomen                                                                     | Koch, Heft 29, fig. 9.                               |
| — <i>pigerrimus</i> .                                    | Very dark; like <i>N. bicarinatus</i>                                                                                              | Koch, Heft 38, fig. 3.                               |
| — <i>posticus</i> .....                                  | Red-brown, broadest at the progaster; probably a nymph                                                                             | Koch, Heft 30, fig. 5.                               |
| — <i>pulverulentus</i>                                   | Very like <i>Damæus verticillipes</i>                                                                                              | Koch, Heft 29, fig. 3.                               |
| — <i>quadracanthus</i>                                   | Said to be of the nature of <i>N. echinatus</i> . Qy. <i>N. horridus</i>                                                           | Haupt., Käfermilben um Bamberg.                      |
| — <i>scaliger</i> .....                                  | Of the nature of <i>N. theleproctus</i> , but larval skin furthest back; said by Haller to be the young of <i>N. theleproctus</i>  | Koch, Heft 29, fig. 11; Haller, Misc. Acar., p. 507. |
| — <i>sordidus</i> .....                                  | Squarish, with long, stiff hairs on lateral margin of abdomen, but without apophyses                                               | Koch, Heft 29, fig. 20.                              |
| — <i>spirofilus</i> ...                                  | Something like <i>N. peltifer</i> , Koch                                                                                           | Haupt., Käfermilben um Bamberg.                      |
| <i>Oppia microptera</i> ...                              | A <i>Notaspis</i> , 1 mm. long; lamellæ long; pseudo-stigmatic organs fusiform, recurved; no markings nor hairs on body            | Berlese, Acari, &c. Ital., fasc. xx, tav. 9.         |
| <i>Oribata</i> } <i>agilis</i> .<br>or <i>Oribates</i> } | Like <i>O. Lucasii</i> , but smaller; no translamella; lamellar hairs strongly serrated; inter-lamellar hairs reflexed             | Nic., p. 432.                                        |
| — <i>Americana</i> ...                                   | An American species; lamellæ serrated; inter-lamellar hairs very long, thickened at the ends, pilose                               | Haller, Beschreibung einiger neuen Milben, p. 222.   |
| — <i>angulatus</i> ...                                   | With undulated hind margin to abdomen                                                                                              | Koch, Heft 30, fig. 21.                              |

| Name.                                                              | Characters.                                                                                                                                                                          | Reference.                                                                |
|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| <i>Oribata</i> } <i>aspi-</i><br>or <i>Oribates</i> } <i>dioti</i> | Said to feed on Orange-<br>Scale Insect                                                                                                                                              | Ashmead, Canad. Entom., May, 1879.                                        |
| — <i>aterrimus</i> ...                                             | Like <i>O. gilvipes</i> , Koch,<br>black and shining                                                                                                                                 | Koch, Heft 38, fig. 10.                                                   |
| — <i>calcaratus</i> ...                                            | A round, black species,<br>with very large cusps (of<br>the lamellæ). Berlese's<br>species of same name<br>seems different from<br>Koch's, and resembles <i>O.<br/>quadricornuta</i> | Koch, Heft 2, fig. 13;<br>Berlese, Acari, &c.<br>Ital., fasc. ix, tav. 2. |
| — <i>clypeata</i> .....                                            | Abdomen wide in front,<br>narrow behind                                                                                                                                              | Nic., p. 437.                                                             |
| — <i>coracinus</i> ...                                             | A <i>Notaspis</i> , like <i>lucorum</i> ,<br>black (supposed by Cane-<br>strini to be <i>Leiosoma<br/>simile</i> )                                                                   | Koch, Heft 31, fig. 1.                                                    |
| — <i>dentatus</i> .....                                            | Pseudo-stigmatic organs<br>very long, fine, and re-<br>curved                                                                                                                        | Berlese, Acari, &c.<br>Ital., fasc. ix, tav. 3.                           |
| — <i>depauperatus</i>                                              | Rather like <i>O. cuspidata</i> ,<br>Michael, but with shorter<br>legs                                                                                                               | Berlese, Acari Ital.,<br>fasc. xxxv, tav. 6.                              |
| — <i>facula</i> .....                                              | A smooth, oval species,<br>with a light patch near<br>the progaster                                                                                                                  | Koch, Heft 30, fig. 17.                                                   |
| — <i>femoralis</i> (or<br><i>femorata</i> )                        | See Vol. I, p. 260                                                                                                                                                                   | Nic., p. 433.                                                             |
| — <i>flammula</i> ...                                              | Like <i>O. calcaratus</i> , Koch,<br>but half the size                                                                                                                               | Koch, Heft 30, fig. 16.                                                   |
| — <i>fuscus</i> .....                                              | A <i>Notaspis</i> resembling <i>N.<br/>lucorum</i>                                                                                                                                   | Koch, Heft 31, fig. 2.                                                    |
| — <i>fusifer</i> .....                                             | A <i>Notaspis</i> , small, oval,<br>brown                                                                                                                                            | Koch, Heft 31, fig. 3.                                                    |
| — <i>gilvipes</i> .....                                            | Pteromorphæ very small                                                                                                                                                               | Koch, Heft 30, fig. 14.                                                   |
| — <i>globosus</i> .....                                            | A <i>Notaspis</i> ; abdomen glo-<br>bose; considered by Ber-<br>lese to be a <i>Leiosoma</i>                                                                                         | Koch, Heft 38, fig. 12.                                                   |
| — <i>globulus</i> .....                                            | A <i>Notaspis</i> , small; whole<br>creature globular, pseudo-<br>stigmatic organs long                                                                                              | Koch, Heft 31, fig. 4.                                                    |
| — <i>humeralis</i> ...                                             | Rather like <i>O. alata</i> , but<br>with points at the side of<br>the rostrum and smaller<br>pteromorphæ                                                                            | Hermann, p. 92; Ber-<br>lese, Acari, &c. Ital.,<br>fasc. iii, tav. 4.     |
| — <i>languida</i> ...                                              | Like <i>O. punctata</i> , but ab-<br>domen with large trans-<br>verse depressions                                                                                                    | Nic., p. 434.                                                             |
| — <i>latipes</i> .....                                             | The same as <i>Zetes latipes</i> ,<br>Koch                                                                                                                                           | Can. e Fan., p. 17;<br>Berlese, Acari, &c.<br>Ital., fasc. xxx, tav. 3.   |

| Name.                                                             | Characters.                                                                                                                                                           | Reference.                                                                                         |
|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| <i>Oribata</i> } <i>longi-</i><br>or <i>Oribates</i> } <i>pes</i> | A small globular species<br>with a translamella                                                                                                                       | Berlese, fasc. xxxv, tav.<br>5.                                                                    |
| — <i>monodactyla</i>                                              | An American species ;<br>pseudo-stigmatic organs<br>long, gradually clavate,<br>closely pectinated. Said<br>by Berlese to be identical<br>with his <i>O. dentatus</i> | Haller, Beschreibung<br>einiger neuen Mil-<br>ben, p. 221                                          |
| — <i>mucronatus</i>                                               | Like <i>O. alata</i> , but with two<br>posterior projections to<br>abdomen                                                                                            | G. Canestrini, Prosp.<br>Acarof. Ital., p. 13.                                                     |
| — <i>Nicoletii</i> .....                                          | The same as <i>O. ovalis</i> , Nic.                                                                                                                                   | Berlese, Acari, &c.<br>Ital., fasc. iii, tav. 3.<br>Nic., p. 439.                                  |
| — <i>ovalis</i> .....                                             | Pteromorphæ like <i>O. puncta-</i><br><i>tata</i> , but lamellæ ordinary                                                                                              |                                                                                                    |
| — <i>ovatus</i> ... ....                                          | A <i>Notaspis</i> , like <i>N. lucorum</i> ,<br>supposed by Canestrini<br>to be identical with <i>Leio-</i><br><i>soma simile</i>                                     | Koch, Heft 30, fig. 24.                                                                            |
| — <i>picipes</i> .....                                            | Small, polished, oval                                                                                                                                                 | Koch, Heft 30, fig. 15.                                                                            |
| — <i>punctum</i> .....                                            | Small, semi-globose                                                                                                                                                   | Koch, Heft 30, fig. 22 ;<br>Can. e Fan., p. 16.                                                    |
| — <i>Rileyi</i> .....                                             | An American species ;<br>cephalothorax small ;<br>pteromorphæ extending<br>very far back                                                                              | Haller, Beschreibung<br>einiger neuen Mil-<br>ben, p. 223.                                         |
| — <i>simplex</i> .....                                            | An American species ;<br>abdomen globular, with<br>six rows of hook-shaped<br>hairs ; pseudo-stigmatic<br>organs short, clavate                                       | Haller, Beschreibung<br>einiger neuen Mil-<br>ben, p. 221.                                         |
| — <i>subterraneus</i>                                             | A <i>Notaspis</i> ; abdomen glo-<br>bose ; supposed by Ber-<br>lese to be a <i>Leiosoma</i>                                                                           | Koch, Heft 38, fig. 11.                                                                            |
| <i>Pelops auritus</i> .....                                       | Two thick hairs on hind<br>margin                                                                                                                                     | Koch, Heft 30, fig. 11 ;<br>Berlese, fasc. xv, tav.<br>8.                                          |
| — <i>glaber</i> .....                                             | Very like <i>P. laevigatus</i>                                                                                                                                        | G. Canestrini, Prosp.<br>Acarof. Ital., p. 12.                                                     |
| — <i>occultus</i> .....                                           | Black, globose ; four thick<br>hairs on hind margin                                                                                                                   | Koch, Heft 2, fig. 15 ;<br>Nic., p. 427.                                                           |
| — <i>tardus</i> .....                                             | Margin of abdomen tuber-<br>culated                                                                                                                                   | Koch, Heft 2, fig. 16.                                                                             |
| — <i>torulosus</i> .....                                          | Black, circular ; six hairs<br>on hind margin                                                                                                                         | Koch, Heft 30, fig. 13 ;<br>Can. e Fan., p. 11 ;<br>G. Canestrini, Prosp.<br>Acarof. Ital., p. 11. |
| — <i>ureaceus</i> .....                                           | Small ; four hairs on hind<br>margin                                                                                                                                  | Koch, Heft 30, fig. 12 ;<br>Berlese, Acari, &c.<br>Ital., fasc. xv, tav. 7.                        |

| Name.                        | Characters.                                                                                             | Reference.                                                                                        |
|------------------------------|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| <i>Pelops variolosus</i> ... | Very coarsely areolated; possibly <i>P. torulosus</i> , Koch                                            | Nic., p. 427. ;                                                                                   |
| <i>Tegeocranus clypeatus</i> | Very elaborately marked; five parallel ridges on cephalothorax                                          | Nic., p. 467.                                                                                     |
| <i>Tritia decumana</i> ..... | Pseudo-stigmatic organs filiform; stated, probably erroneously, to be <i>Hoplophora decumana</i> , Koch | Berlese, Acari, &c.<br>Ital., fasc. vi, tav. 2.                                                   |
| — <i>lentula</i> .....       | Said to be the same as <i>Hoplophora lentula</i> , Koch                                                 | G. Canestrini, Prosp. Acarof. Ital., p. 45;<br>Berlese, Acari, &c.<br>Ital., fasc. xxxvi, tav. 3. |
| — <i>nuda</i> .....          | Like <i>Hoplophora ardua</i> , but pseudo-stigmatic organs filiform                                     | Berlese, Acari, &c.<br>Ital., fasc. xxxv, tav. 9.                                                 |
| <i>Zetes cespitum</i> .....  | Abdomen globose; pteromorphæ large; pseudo-stigmatic organs long                                        | Koch, Heft 31, fig. 8.                                                                            |
| — <i>flavipes</i> .....      | A <i>Notaspis</i> like <i>N. lucorum</i>                                                                | Koch, Heft 31, fig. 16.                                                                           |
| — <i>fuscomaculatus</i> .    | A nymph                                                                                                 | Koch, Heft 31, fig. 11.                                                                           |
| — <i>gilvulus</i> .....      | A <i>Notaspis</i>                                                                                       | Koch, Heft 31, fig. 17.                                                                           |
| — <i>laevigatus</i> .....    | An <i>Oribata</i> , see p. 262                                                                          | Koch, Heft 3, fig. 8.                                                                             |
| — <i>latipes</i> .....       | Small, with small pteromorphæ                                                                           | Koch, Heft 38, fig. 14.                                                                           |
| — <i>latirostris</i> .....   | Broad, black                                                                                            | Koch, Heft 38, fig. 13.                                                                           |
| — <i>longiusculus</i> ...    | A <i>Notaspis</i> , very long-shaped                                                                    | Koch, Heft 31, fig. 19.                                                                           |
| — <i>morticinus</i> .....    | A nymph                                                                                                 | Koch, Heft 31, fig. 14.                                                                           |
| — <i>pallidulus</i> .....    | Like <i>Z. latipes</i>                                                                                  | Koch, Heft 31, fig. 9.                                                                            |
| — <i>rubens</i> .....        | Small, red, globular                                                                                    | Koch, Heft 31, fig. 10.                                                                           |
| — <i>semirufus</i> .....     | Hind part black, front red                                                                              | Koch, Heft 31, fig. 7.                                                                            |

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THE END.

## ERRATA IN VOL. I.

- Page 78. For *Damæus splendens* read *Notaspis splendens*.  
" " *Hoplophora nitens* " *Hoplophora dasypus*.  
Pages 91, 97 " *Eremæus oblongus* " *Notaspis oblonga*.  
Page 91 " *Damæus monilipes* " *Notaspis monilipes*.  
" 196 " *Oribata mucronata* " *Oribata cuspidata*.

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Synonyms of species are in *italics*, their genera in *ITALIC CAPITALS*.

Names of Genera of Acarina (not synonyms) are in **SMALL CAPITALS**.

Species which have not been recorded as British have an F. (foreign) following the name.

Where more than one reference follow the name of a genus, species, or part, that indicating the principal description is in Clarendon type.

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  “ *fuscomaculatus*, F., 618.

  “ *gilvulus*, F., 618.

  “ *lævigatus*, F., 262, 618.

  “ *latipes*, F., 617, 618.

  “ *latirostris*, F., 618.

  “ *longiusculus*, F., 618.

  “ *lucorum*, 371.

- ZETES, mortacinus, F., 618.  
" pallidulus, F., 618.  
" *pilosulus*, 370.  
" *pilosus*, 370.  
" rubens, F., 618.  
" *satellitius*, 257.  
" semirufus, 618.

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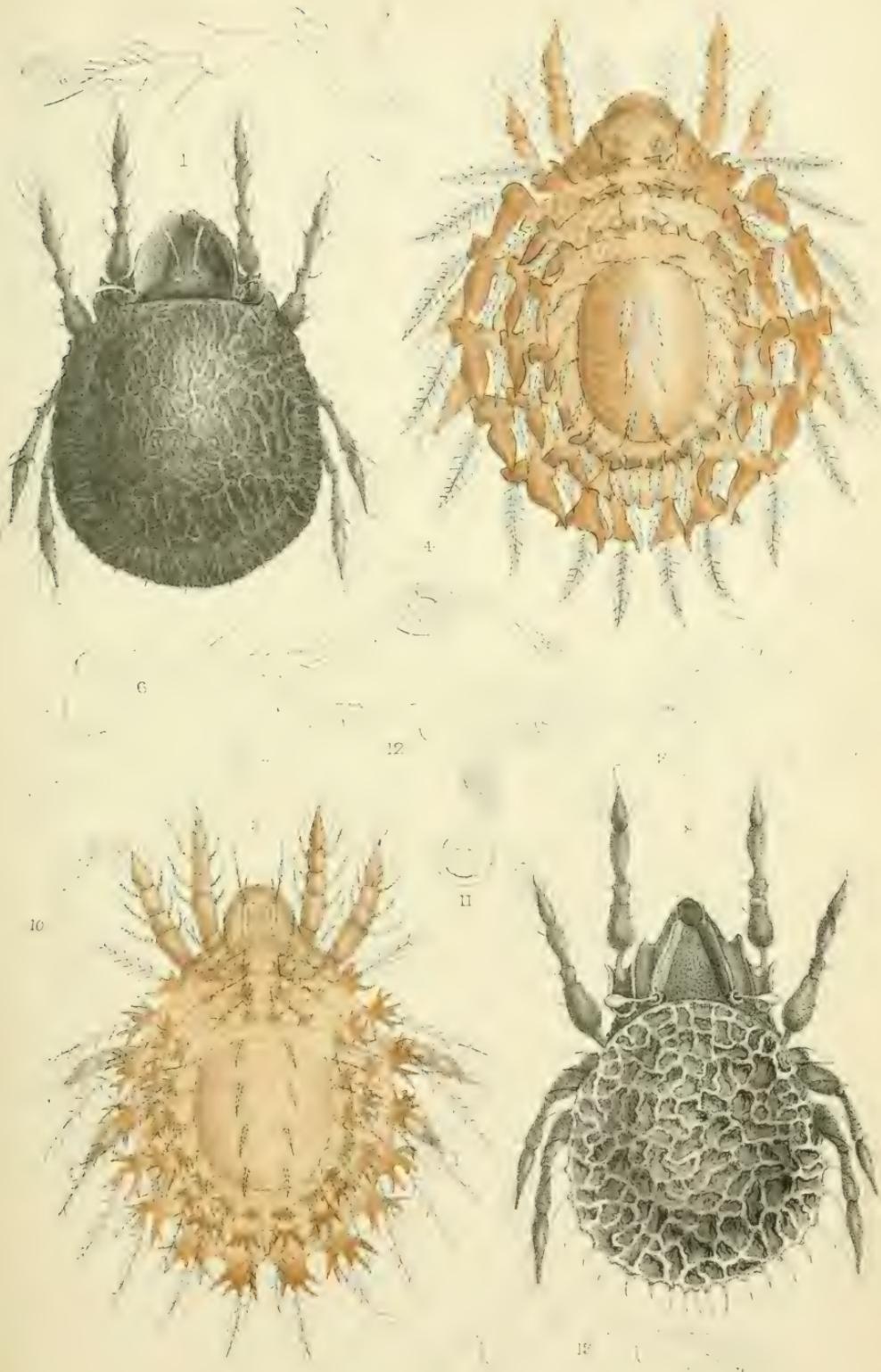
## PLATE XXV.

*TEGEOCRANUS CEPHEIFORMIS.* (Page 340.)  
Length about .62 mm.

- Fig. 1. Adult.  $\times$  80.  
2. Nymph.  
3. Adult; mandible from above.  $\times$  250.  
4. Adult; pseudo-stigma and pseudo-stigmatic organ.  
 $\times$  250.  
5. Adult; first right leg from the left (inner) side.  
 $\times$  150.  
6. Adult; third right leg from the left (inner) side.  
 $\times$  150.  
7. Adult; fourth left leg from the right (inner) side.  
 $\times$  150.

*TEGEOCRANUS HERICIUS.* (Page 346.)  
Length about .59 mm.

8. Adult.  $\times$  90.  
9. Nymph.  
10. Adult; palpus.  $\times$  260.  
11. Adult; pseudo-stigma and pseudo-stigmatic organ.  
 $\times$  260.  
12. Adult; first right leg from the right (outer) side.  
 $\times$  145.  
13. Adult; third left leg from the left (outer) side.  
 $\times$  145.



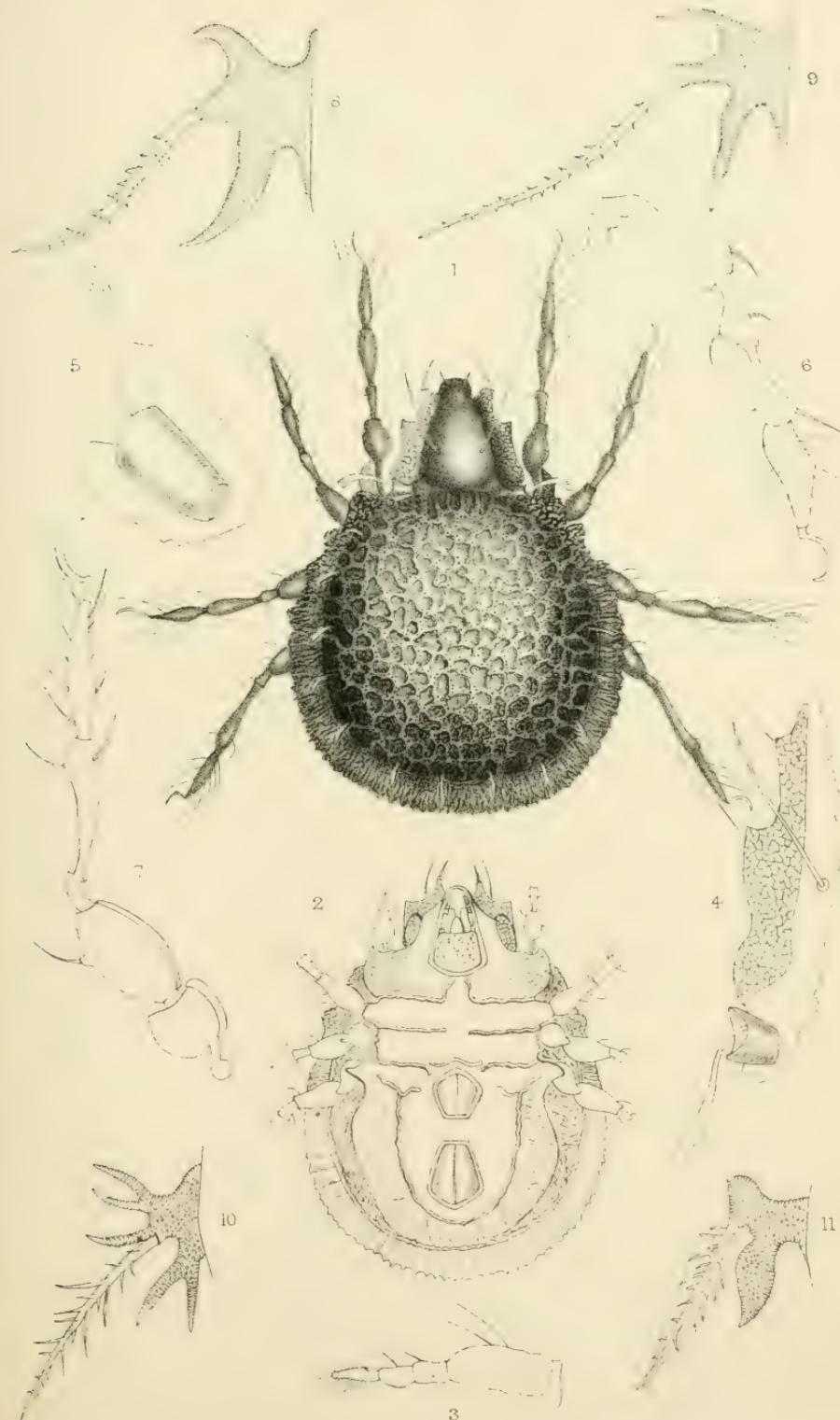




## PLATE XXVI.

TEGEOCRANUS DENTATUS. (Page 338.)  
Length about .80 mm.

- Fig. 1. Adult.  $\times 70$ .
- 2. Adult; under side.
- 3. Adult; palpus.  $\times 300$ .
- 4. Adult; left lamella and pseudo-stigma.  $\times 150$ .
- 5. Adult; pseudo-stigma and pseudo-stigmatic organ from within.  $\times 300$ .
- 6. Adult; first left leg from within.  $\times 150$ .
- 7. Adult; fourth left leg from without.  $\times 150$ .
- 8. Sixth projection and spine from the edge of the abdomen of the fully-grown nymph of *Tegeocranus latus*.  $\times 150$ .
- 9. The same from the nymph of *Tegeocranus dentatus*.  $\times 150$ .
- 10. The same from the nymph of *Tegeocranus hericius*.  $\times 150$ .
- 11. The same from the nymph of *Tegeocranus cephei-formis*.  $\times 150$ .



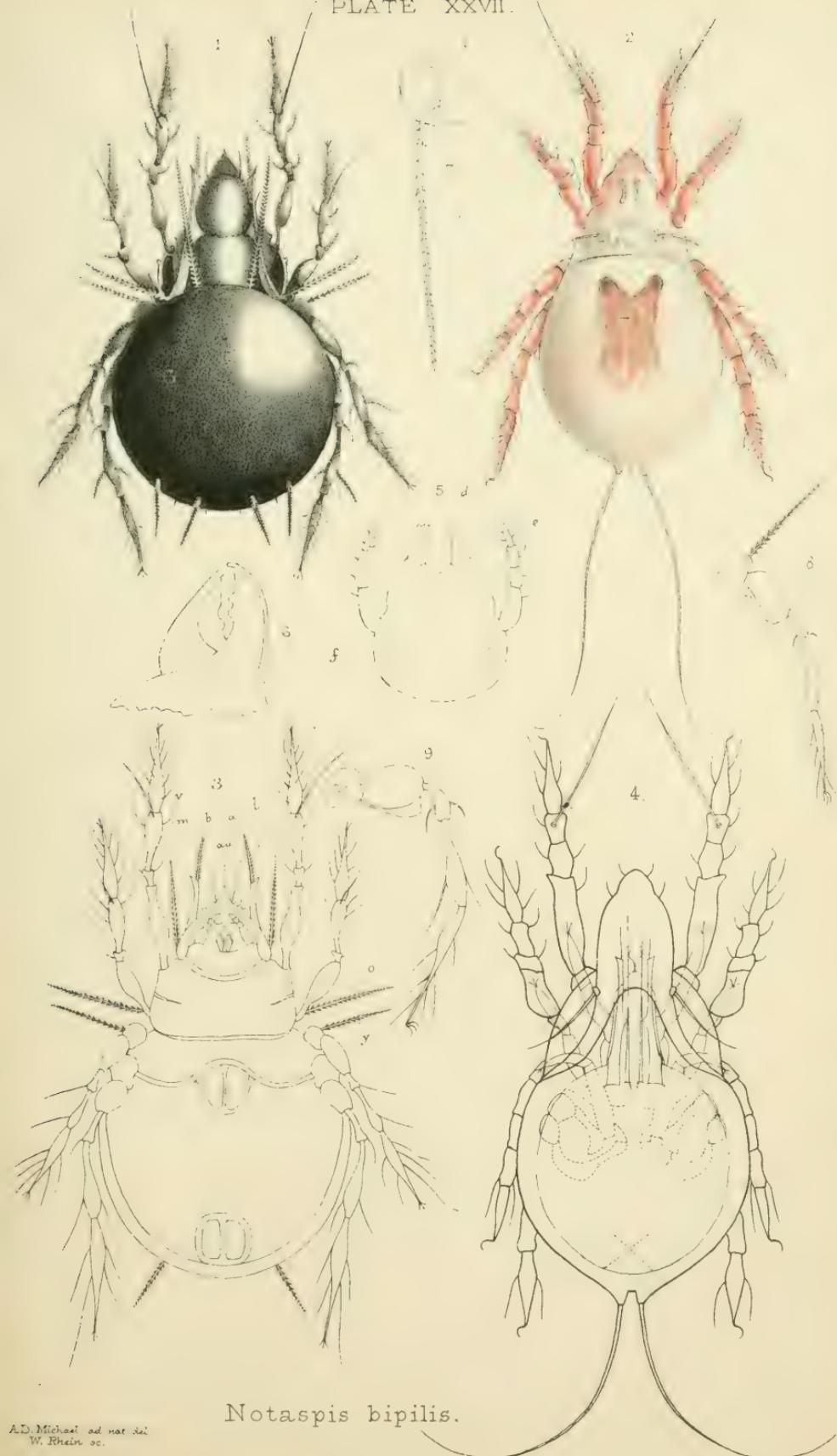




## PLATE XXVII.

*NOTASPIS BIPILIS.* (Page 356.)  
Length about .65 mm.

- Fig. 1. Adult.  $\times 80$ .  
2. Nymph.  
3. Adult; under side; (*a*) edge of epistome (camerastomum); (*a a*) point of rostrum; (*b*) rostral hair; (*l*) lamella; (*m*) lamellar hair; (*o*) pseudo-stigmatic organ; (*v*) inter-lamellar hair; (*y*) spine on third coxa.  
4. Inert nymph showing the adult fully formed inside to demonstrate the mode in which the legs, spines, &c., of the adult are packed within the nymphal skin.  
5. Adult; (*f*) labium; (*d*) maxilla almost on edge; (*e*) palpus.  $\times 150$ .  
6. Adult; chelate portion of mandible.  $\times 350$ .  
7. (*s*) Pseudo-stigma; (*o*) pseudo-stigmatic organ.  $\times 350$ .  
8. Adult; third right leg, three-quarter view, showing the articular portion of the coxa.  $\times 80$ .  
9. Adult; fourth right leg seen from the left (inner) side.  $\times 80$ .



Notaspis bipilis.





## PLATE XXVIII.

*NOTASPIS EXILIS.* (Page 359.)  
Length about .37 mm.

- Fig. 1. Adult.  $\times 125$ .
2. Nymph.
3. Adult; palpus.  $\times 250$ .
4. Adult; (*s*) pseudo-stigma and (*o*) pseudo-stigmatic organ.  $\times 450$ .
5. Adult; first left leg from the outer (left) side.  $\times 250$ .

*NOTASPIS TIBIALIS.* (Page 362.)  
Length about .48 mm.

6. Adult.  $\times 100$ .
7. Adult; (*s*) pseudo-stigma and (*o*) pseudo-stigmatic organ.  $\times 380$ .
8. Adult; first left leg from the outer (left) side.  $\times 180$ .

*NOTASPIS JUNCTA.* (Page 365.)  
Length about .22 mm.

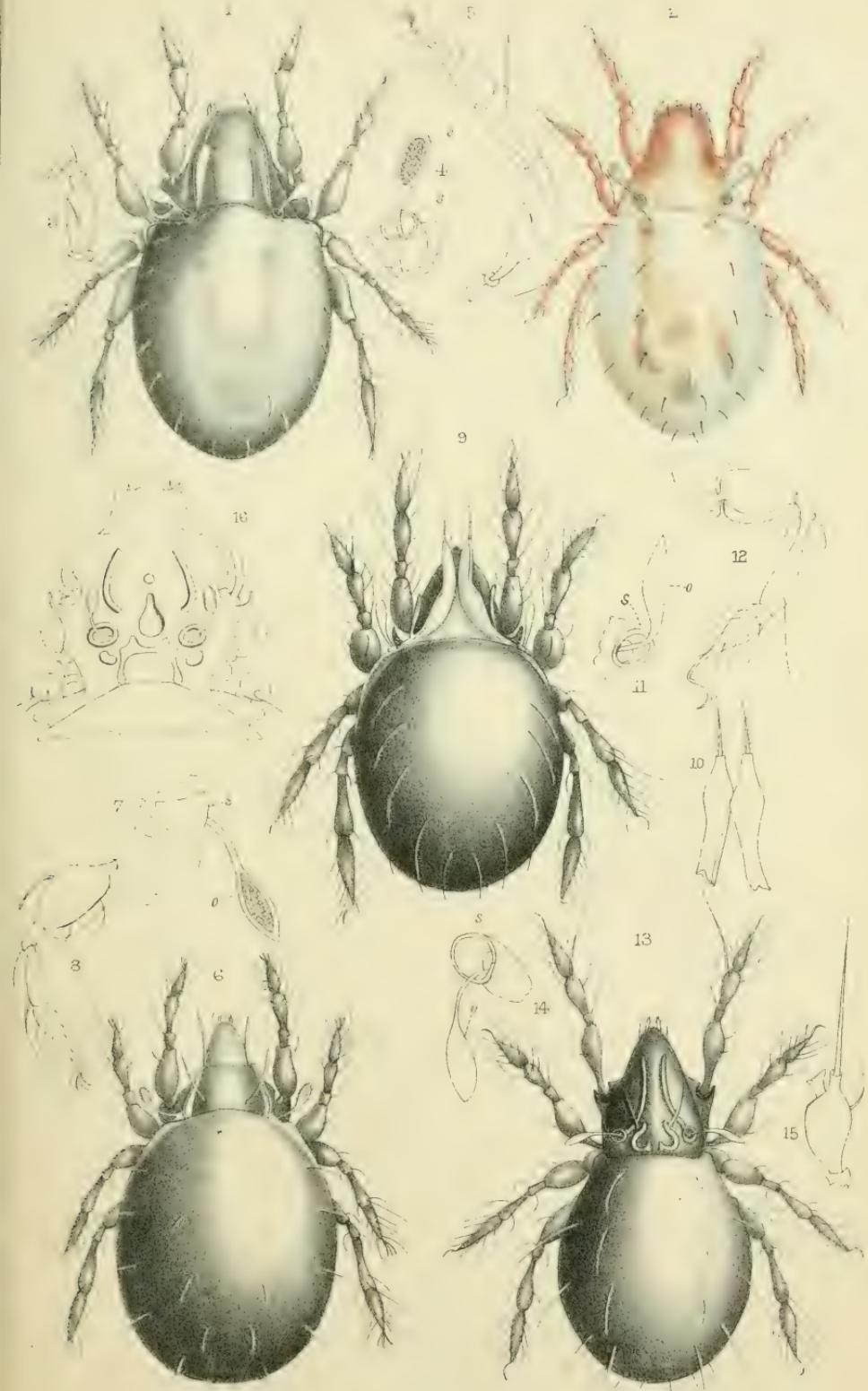
9. Adult.  $\times 200$ .
10. Adult; cusps and anterior portion of the lamellæ seen partly from the right side.  $\times 400$ .
11. Adult; (*s*) pseudo-stigma and (*o*) pseudo-stigmatic organ.  $\times 450$ .
12. Adult; fourth right leg from the inner (left) side.  $\times 400$ .

*NOTASPIS LONGILAMELLATA.* (Page 392.)  
Length about .33 mm.

13. Adult.  $\times 150$ .
14. Adult; (*s*) pseudo-stigma and (*o*) pseudo-stigmatic organ.  $\times 450$ .
15. Adult; tibia of the first leg.  $\times 300$ .

*NOTASPIS TRIGONA.* (Page 396.)  
Length about .24 mm.

16. Adult; outline of cephalo-thorax.  $\times 375$ .



N. Juncta 9-12.

Notaspis exilis 1-5. N. tibialis 6-8. N. longilamellata 13-15. N. trigona 16.

*West, Newman & C°. chr. lith.*





## PLATE XXIX.

*NOTASPIS SERRATA*. (Page 366.)

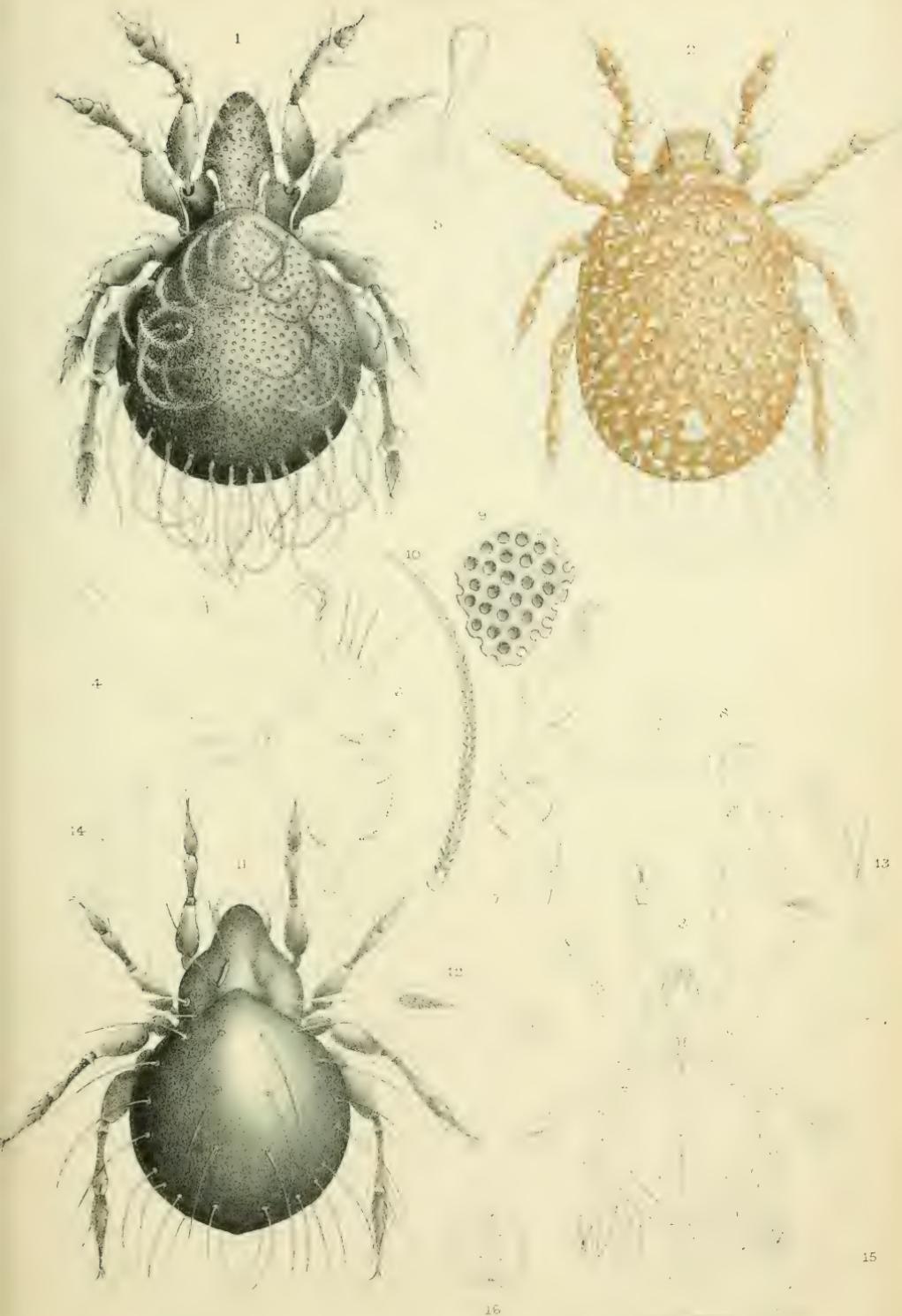
Length about .56 mm.

- Fig. 1. Adult.  $\times 100$ .
2. Nymph.
3. Adult; underside.
4. Adult; mandible.  $\times 300$ .
5. Adult; pseudo-stigma and pseudo-stigmatic organ.  
 $\times 300$ .
6. Adult; first left leg seen from the left (outer) side  
 $\times 145$ .
7. Adult; third left leg seen from the right (inner) side.  $\times 145$ .
8. Adult; fourth right leg seen from the left (inner) side.  $\times 145$ .
9. Adult; a portion of the notogaster to show the pitting.  $\times 300$ .
10. One of the serrated hairs from the notogaster.  
 $\times 300$ .

*NOTASPIS PILOSA*. (Page 370.)

Length about .45 mm.

11. Adult.  $\times 130$ .
12. Adult; pseudo-stigma and pseudo-stigmatic organ.  
 $\times 400$ .
13. Adult; first right leg seen from the inner (left) side.  $\times 180$ .
14. Adult; second right leg from the outer (right) side.  $\times 180$ .
15. Adult; fourth right leg from the inner (left) side.  
 $\times 180$ .
16. Adult; anal plates.  $\times 180$ .



Notaspis serrata  
— a — pilosa.





## PLATE XXX.

**NOTASPIS LUCORUM.** (Page 371.)  
Length about .67 mm.

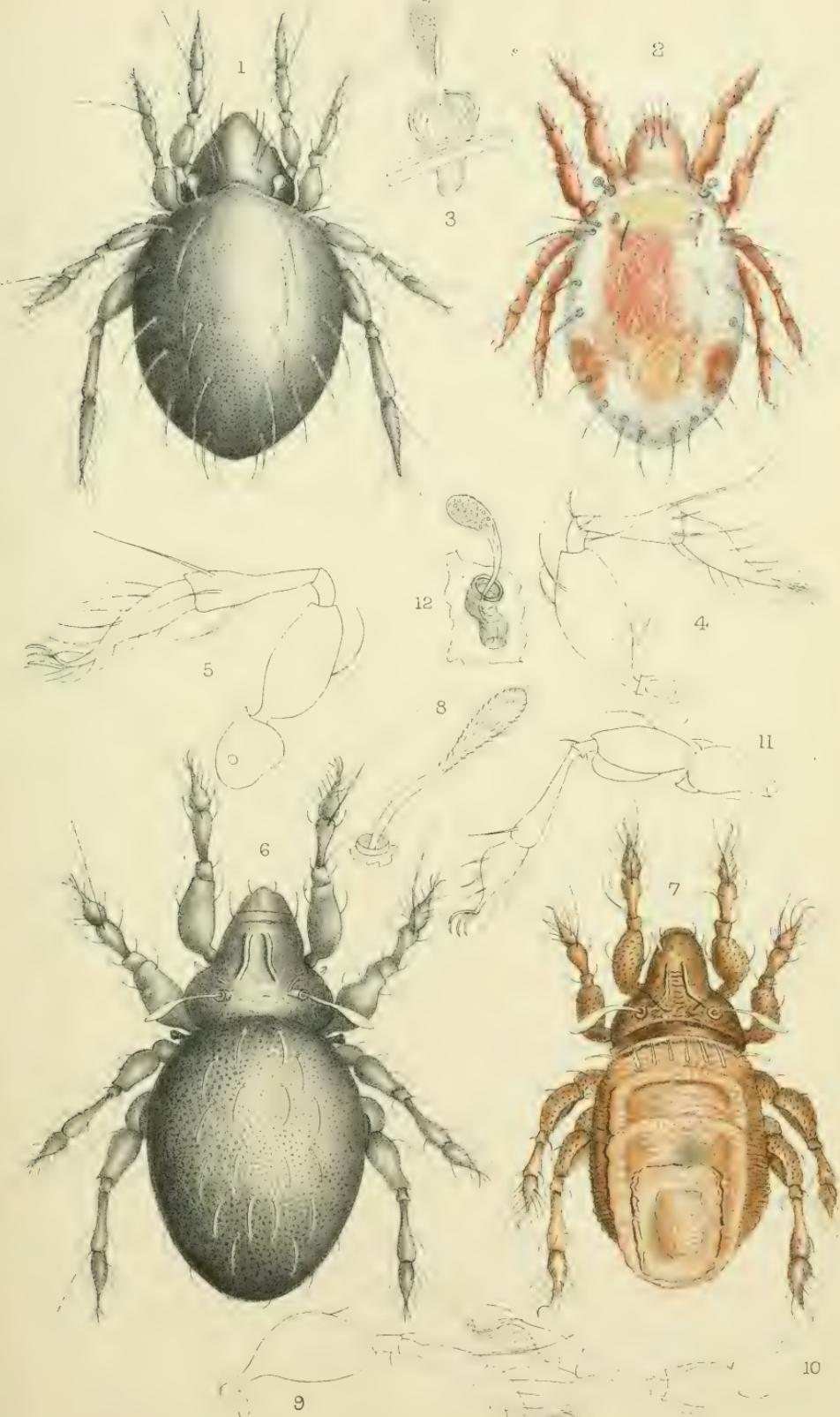
- Fig. 1. Adult.  $\times 70$ .
- 2. Nymph.
- 3. Adult; (s) pseudo-stigma; (o) pseudo-stigmatic organ.  $\times 400$ .
- 4. Adult; first right leg seen from the right (outer) side.  $\times 180$ .
- 5. Adult; third left leg seen from the right (inner) side.  $\times 180$ .

**NOTASPIS OBLONGA.** (Page 374.)  
Length about .60 mm.

- 6. Adult.  $\times 95$ .
- 7. Nymph.
- 8. Adult; pseudo-stigma and pseudo-stigmatic organ.  $\times 400$ .
- 9. Adult; first right leg from the right (outer) side.  $\times 200$ .
- 10. Adult; third right leg from the right (outer) side.  $\times 200$ .
- 11. Adult; fourth left leg from the right (inner) side.  $\times 200$ .

**NOTASPIS LACUSTRIS.** (Page 399.)

- 12. Adult; pseudo-stigma and pseudo-stigmatic organ in a perfect (unbroken) condition.  $\times 800$ .  
(See also Pl. XXXIII.)







## PLATE XXXI.

NOTASPIS MONILIPES. (Page 381.)

Length about .34 mm.

Fig. 1. Adult.  $\times 160$ .

2. Nymph, fully grown, carrying one larval and two nymphal cast notogastral skins.
3. Adult; (*s*) pseudo-stigma; (*o*) pseudo-stigmatic organ.  $\times 350$ .
4. Adult; leg, first pair.  $\times 250$ .
5. Adult; leg, fourth pair.  $\times 250$ .

NOTASPIS LICNOPHORA. (Page 379.)

Length about .19 mm.

6. Adult.  $\times 180$ .

7. Adult; under side.  $\times 195$ . (*a*) epistome; (*i*) genital plates; (*j*) anal plates; (*vp*) ventral plate; (*n*) reflexed portion of the notogaster embracing the ventral plate; (*o*) pseudo-stigmatic organ.
8. Adult; (*s*) pseudo-stigma; (*o*) pseudo-stigmatic organ.  $\times 570$ .

NOTASPIS SIMILIS. (Page 363.)

Length about .55 mm.

9. Adult.  $\times 85$ .

10. Adult; (*s*) pseudo-stigma; (*o*) pseudo-stigmatic organ.  $\times 400$ .
11. Adult; leg, first pair.  $\times 180$ .
12. Adult; leg, fourth pair.  $\times 180$ .

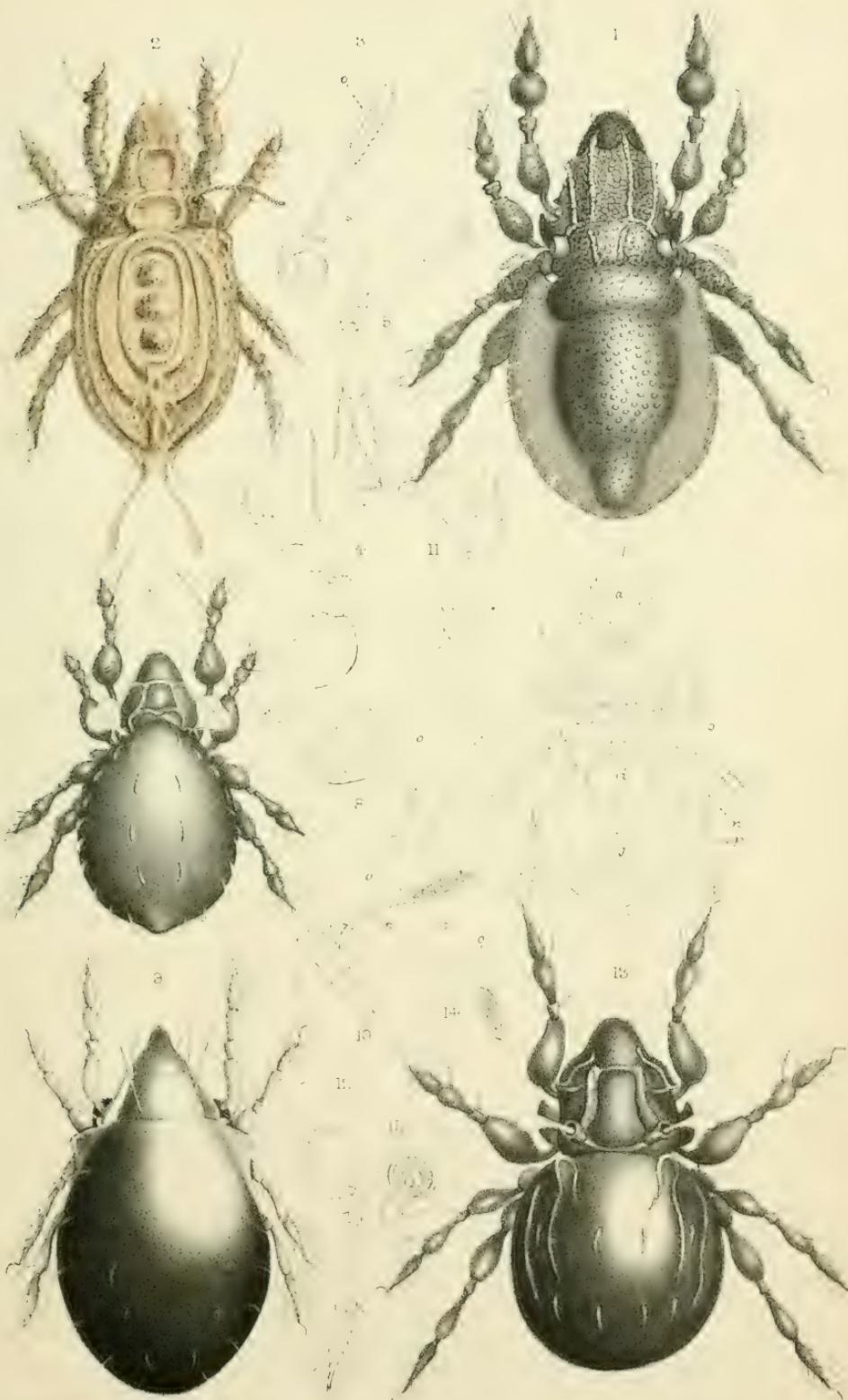
NOTASPIS QUADRICARINATA. (Page 385.)

Length about .2 mm.

13. Adult.  $\times 250$ .

14. Adult; (*s*) pseudo-stigma; (*o*) pseudo-stigmatic organ from the side.  $\times 500$ .

15. Adult; the same from above.  $\times 500$ .



A.D. Michael ad nat. del.

*Notaspis monilipes*, 1-5    *Notaspis similis*, 9-12"    *lichenophorus*, 6-8    "

West, Newman &amp; Co. lith.

"    *quadricarinata*, 13-15.





## PLATE XXXII.

*NOTASPIST PECTINATA.* (Page 389.)

Length about .42 mm.

- Fig. 1. Adult.  $\times 130$ .  
2. Adult, under side.  $\times 100$ .  
3. Nymph.  
4. Adult; (*s*) pseudo-stigma; (*o*) pseudo-stigmatic organ.  $\times 380$ .  
5. Adult; inter-lamellar hair.  $\times 380$ .  
6. Adult; fourth left leg from the outer (left) side.  $\times 200$ .

*NOTASPIST CLAVIPECTINATA.* (Page 387.)

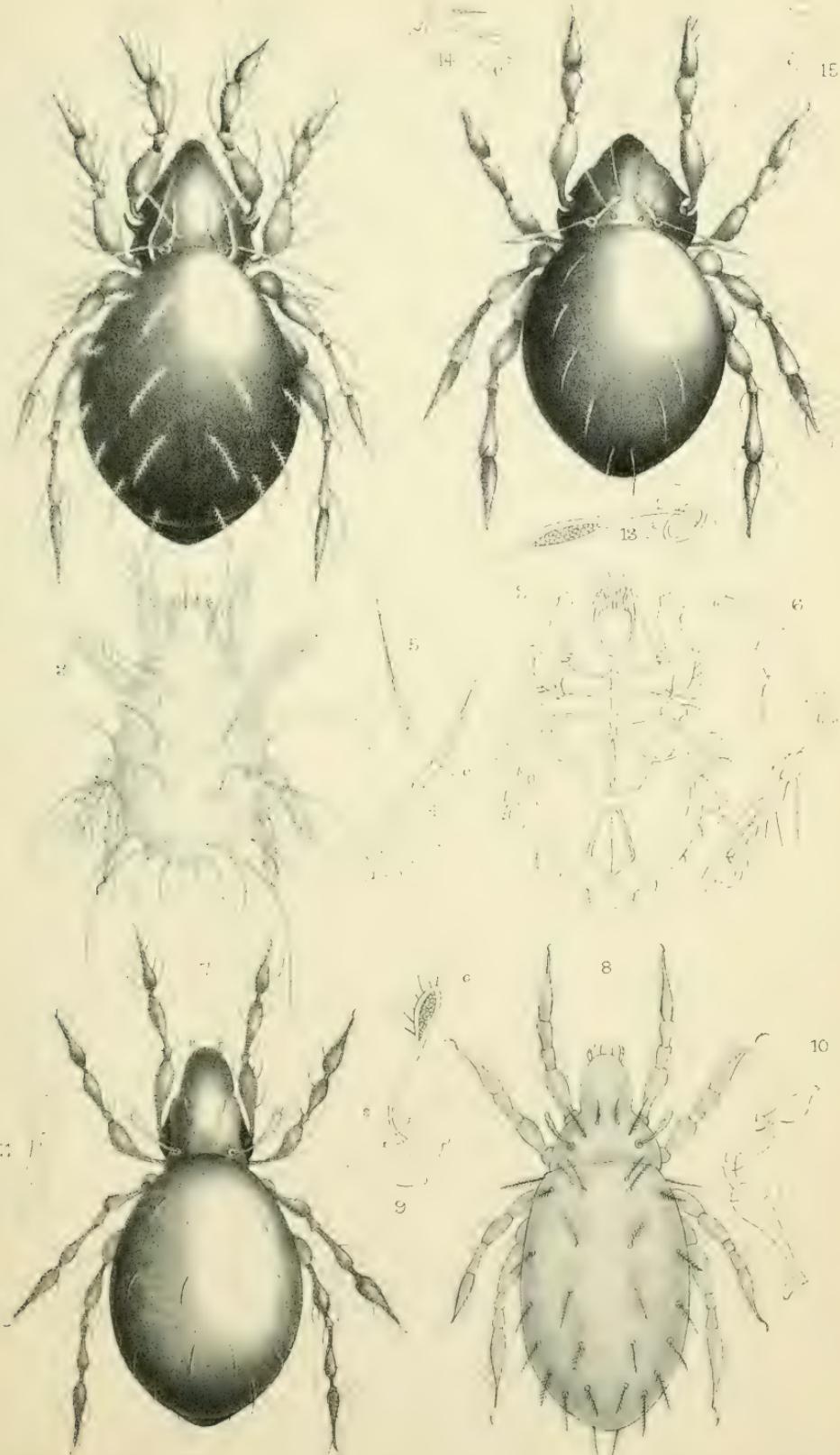
Length about .33 mm.

7. Adult.  $\times 180$ .  
8. Nymph.  
9. Adult; (*s*) pseudo-stigma; (*o*) pseudo-stigmatic organ.  $\times 450$ .  
10. Adult; a portion of first left leg from the inner (right) side.  $\times 380$ .  
11. Adult; coxa and femur of fourth right leg from the outer (right) side.  $\times 380$ .

*NOTASPIST LANCEOLATA.* (Page 398.)

Length about .33 mm.

12. Adult.  $\times 150$ .  
13. Adult; pseudo-stigma and pseudo-stigmatic organ.  $\times 450$ .  
14. Adult; coxa, femur, and genual of the third right leg from above and without.  $\times 275$ .  
15. Adult; coxa and femur of fourth right leg from above and without.  $\times 275$ .







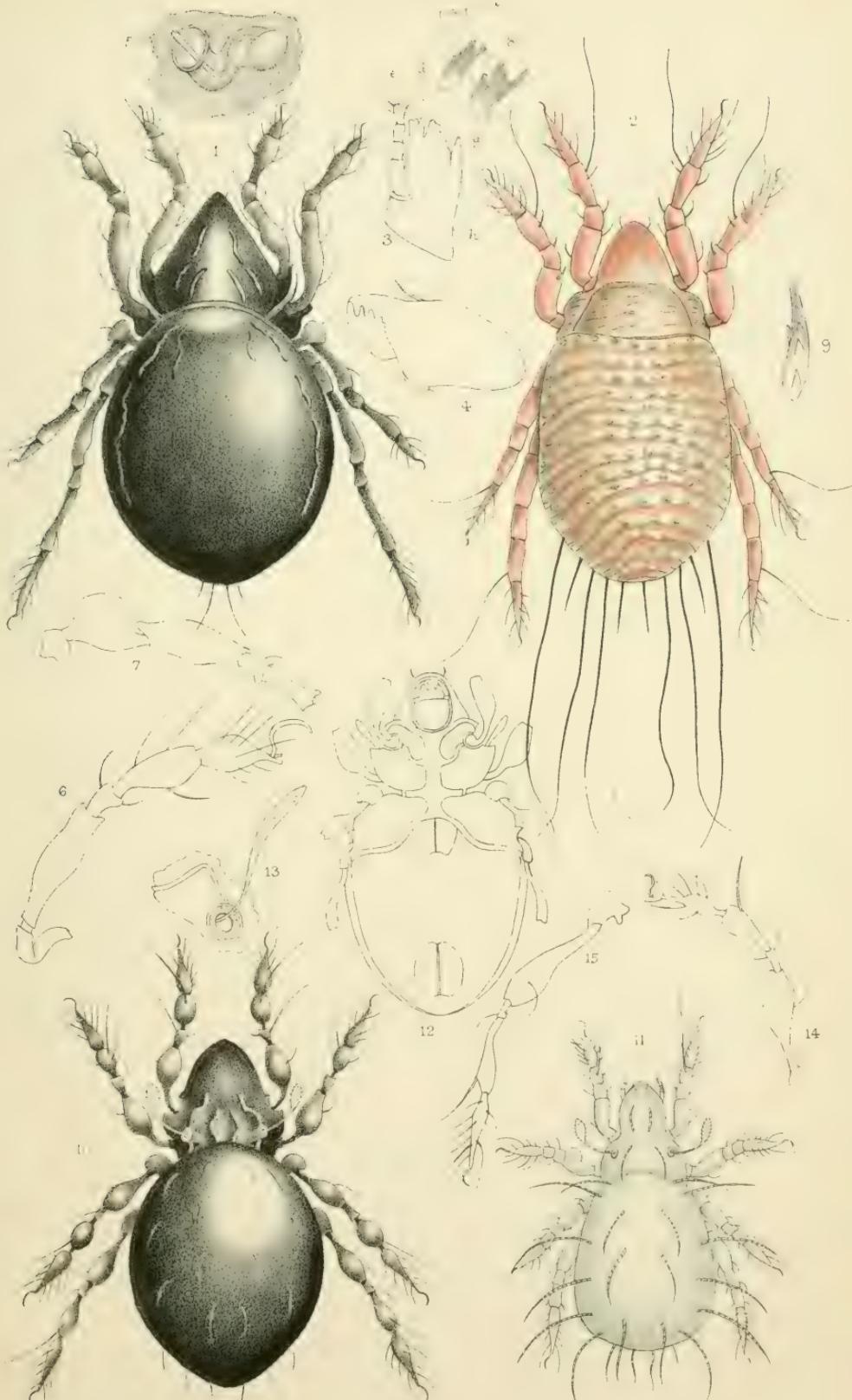
## PLATE XXXIII.

*NOTASPIS LACUSTRIS.* (Page 399.)  
Length about .50 mm.

- Fig. 1. Adult.  $\times 105$ .
- 2. Nymph.
- 3. Adult; left half of the labial organs from above;  
(d) maxilla; (e) palpus; (g) lingua; (h) labium.  
 $\times 150$ .
- 4. Adult; left mandible from the left (outer) side.  
 $\times 200$ .
- 5. Adult; pseudo-stigma and pseudo-stigmatic organ  
in its usual broken condition.  $\times 1200$ . (See  
also Pl. XXX, fig. 12.)
- 6. Adult; leg, first pair.  $\times 150$ .
- 7. Adult; leg, fourth pair.  $\times 150$ .
- 8. Adult; modified hairs or scales by the side of the  
claw; (a) the claw, broken short.
- 9. A hair from the under side of the tarsus.

*NOTASPIS SPLENDENS.* (Page 393.)  
Length about .31 mm.

- 10. Adult.  $\times 165$ .
- 11. Nymph.
- 12. Adult; under side.  $\times 165$ .
- 13. Adult; pseudo-stigma and pseudo-stigmatic organ.  
 $\times 300$ .
- 14. Adult; first right leg seen from the left (inner)  
side.  $\times 220$ .
- 15. Adult; fourth left leg seen from the edge.  $\times 220$ .



Notaspis lacustris.  
— — — splendens





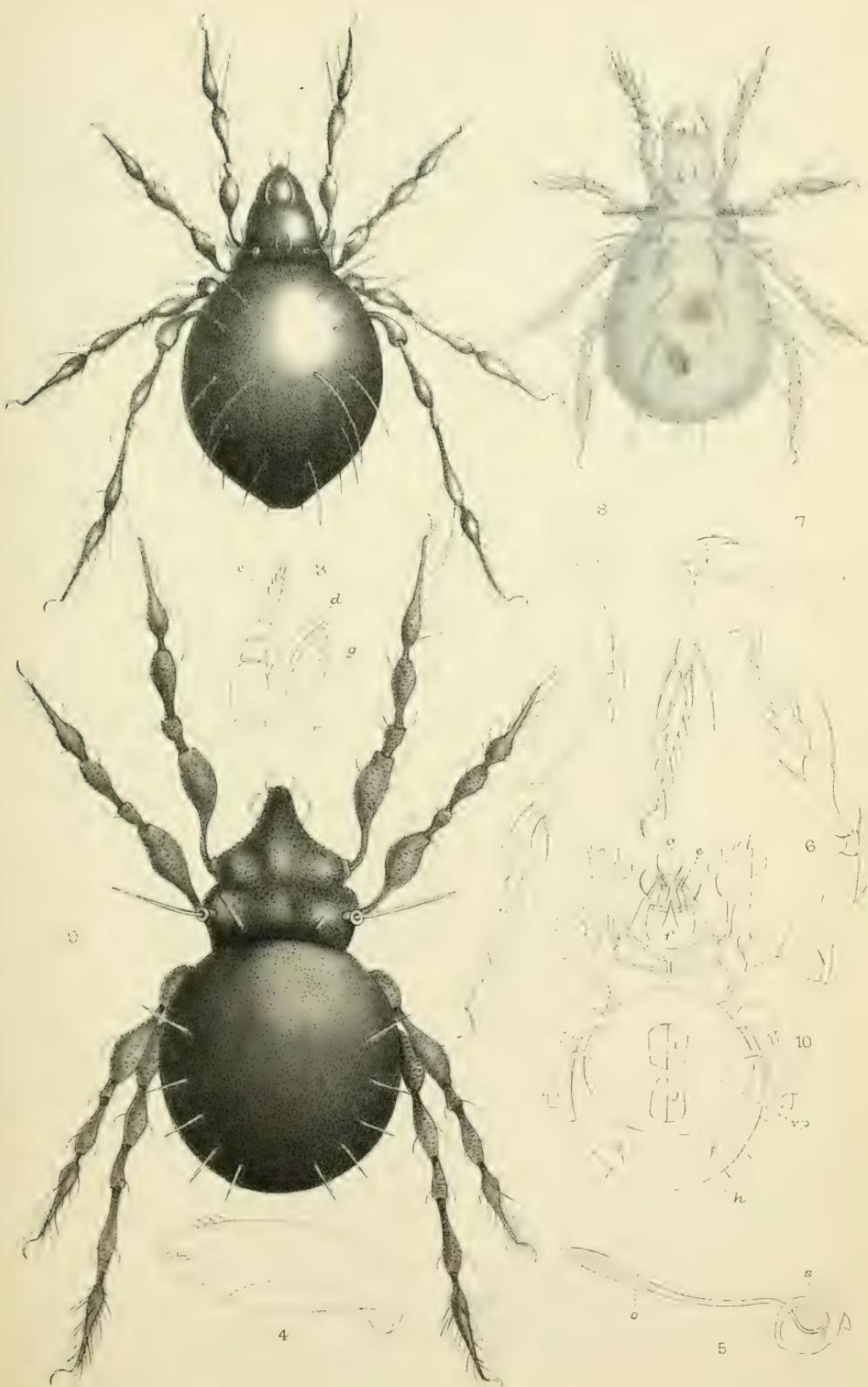
## PLATE XXXIV.

*DAMÆUS NITENS.* (Page 409.)  
Length about .51 mm.

- Fig. 1. Adult.  $\times 95$ .
- 2. Nymph (young).
- 3. Adult; right half of labial organs from above.  
 $\times 400$ . (*d*) maxilla; (*e*) palpus; (*g*) lingua.
- 4. Adult; mandible.  $\times 400$ .
- 5. Adult; (*s*) pseudo-stigma; (*o*) pseudo-stigmatic organ.  $\times 400$ .
- 6. Adult; leg, first pair.  $\times 180$
- 7. Adult; leg, third pair.  $\times 180$ .
- 8. Adult; leg, fourth pair.  $\times 180$ .

*DAMÆUS SUFFLEXUS.* (Page 415.)  
Length about .65 mm.

- 9. Adult.  $\times 80$ .
- 10. Adult; under side.  $\times 58$ . (*a*) epistome; (*e*) palpus; (*f*) labium; (*i*) genital plates; (*j*) anal plates; (*vp*) ventral plate; (*n*) reflexed portion of notogaster embracing the ventral plate.



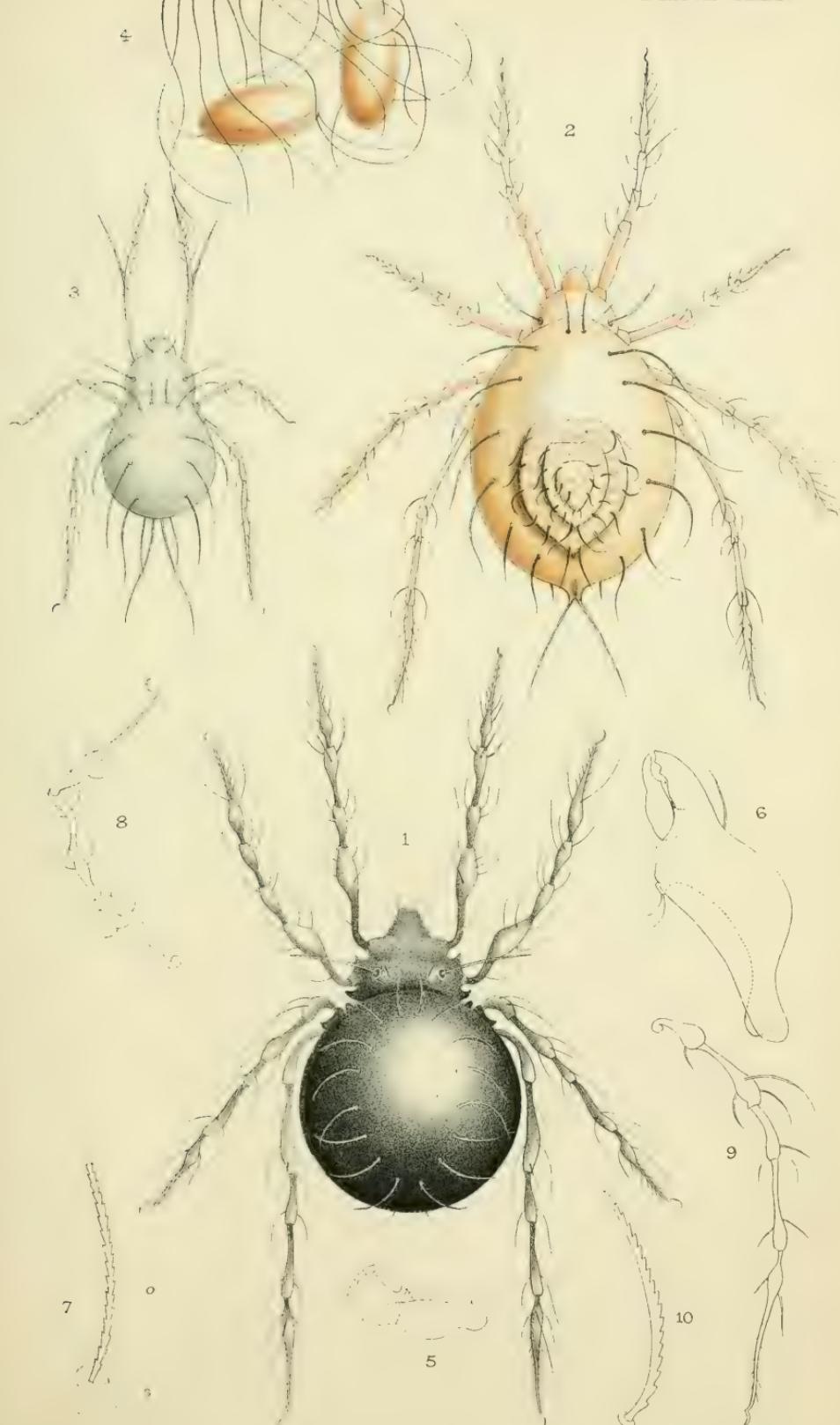




## PLATE XXXV.

DAMÆUS TECTICOLA. (Page 416.)  
Length about .65 mm.

- Fig. 1. Adult.  $\times 65$ .
- 2. Nymph.
- 3. Larva.
- 4. Eggs attached to mycelium of black fungus.
- 5. Adult; labial organs, side view.  $\times 150$ .
- 6. Adult; right mandible from left side.  $\times 150$ .
- 7. Adult; (s) pseudo-stigma; (o) pseudo-stigmatic organ.  $\times 150$ .
- 8. Adult; leg, first pair.  $\times 60$ .
- 9. Adult; leg, fourth pair.  $\times 60$ .
- 10. Adult; one of the hairs or spines on the coxa.  
 $\times 300$ .





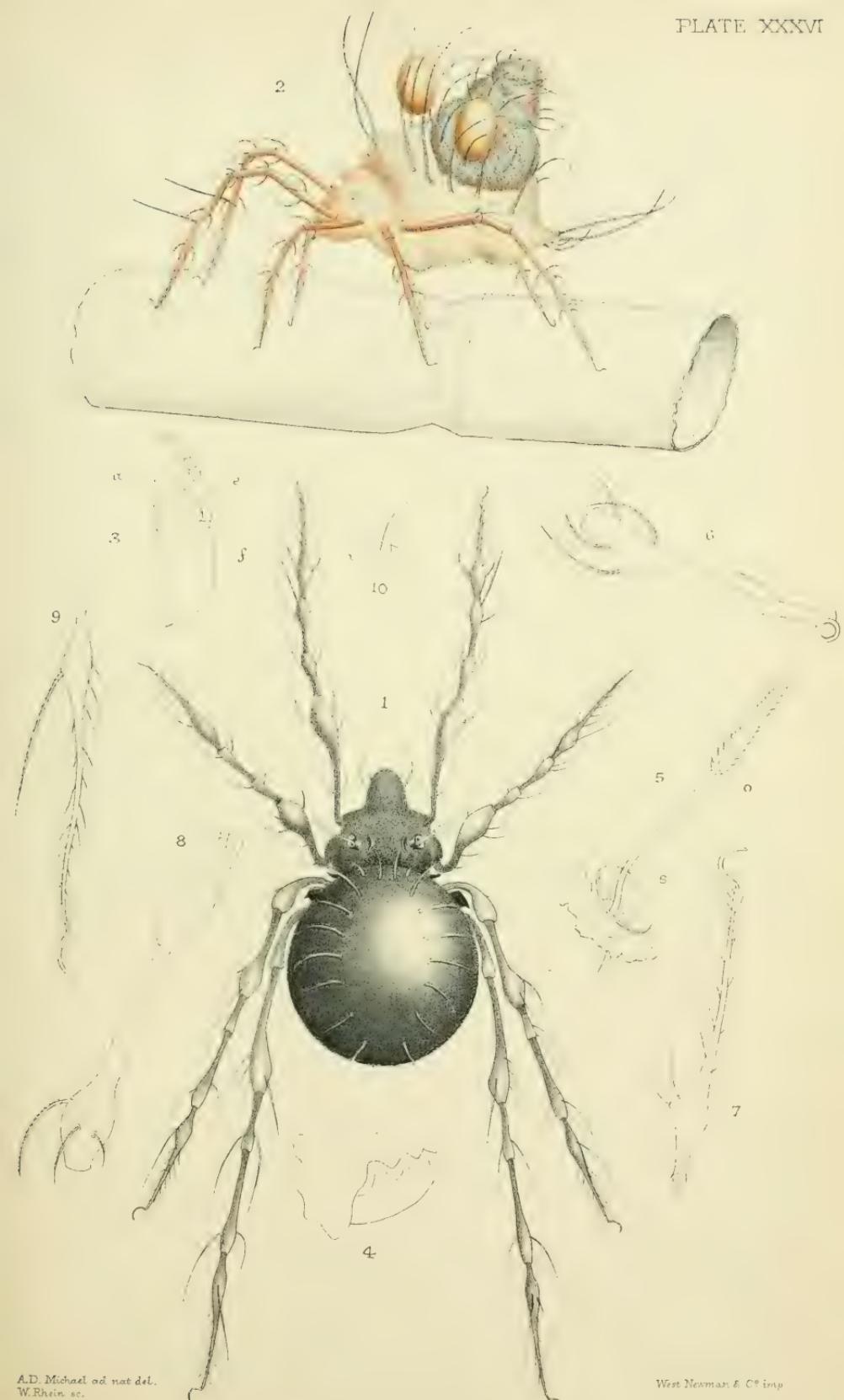


## PLATE XXXVI.

DAMÆUS TENUIPES. (Page 420.)

Length about .67 mm.

- Fig. 1. Adult.  $\times 75$ .
- 2. Nymph.
- 3. Adult; labial organs of the right side seen from below.  $\times 145$ . (d) maxilla; (e) palpus; (f) labium.
- 4. Adult; chelate portion of the right mandible.  $\times 300$ .
- 5. Adult; (s) pseudo-stigma; (o) pseudo-stigmatic organ.  $\times 300$ .
- 6. Adult; femur of the first right leg.  $\times 145$ .
- 7. Adult; tarsus of the first right leg.  $\times 145$ .
- 8. Adult; coxa and femur of the fourth right leg.  $\times 145$ .
- 9. Adult; tarsus of the fourth right leg.  $\times 145$ .
- 10. Adult; the right spine-like projection of the pro-gaster.  $\times 145$ .





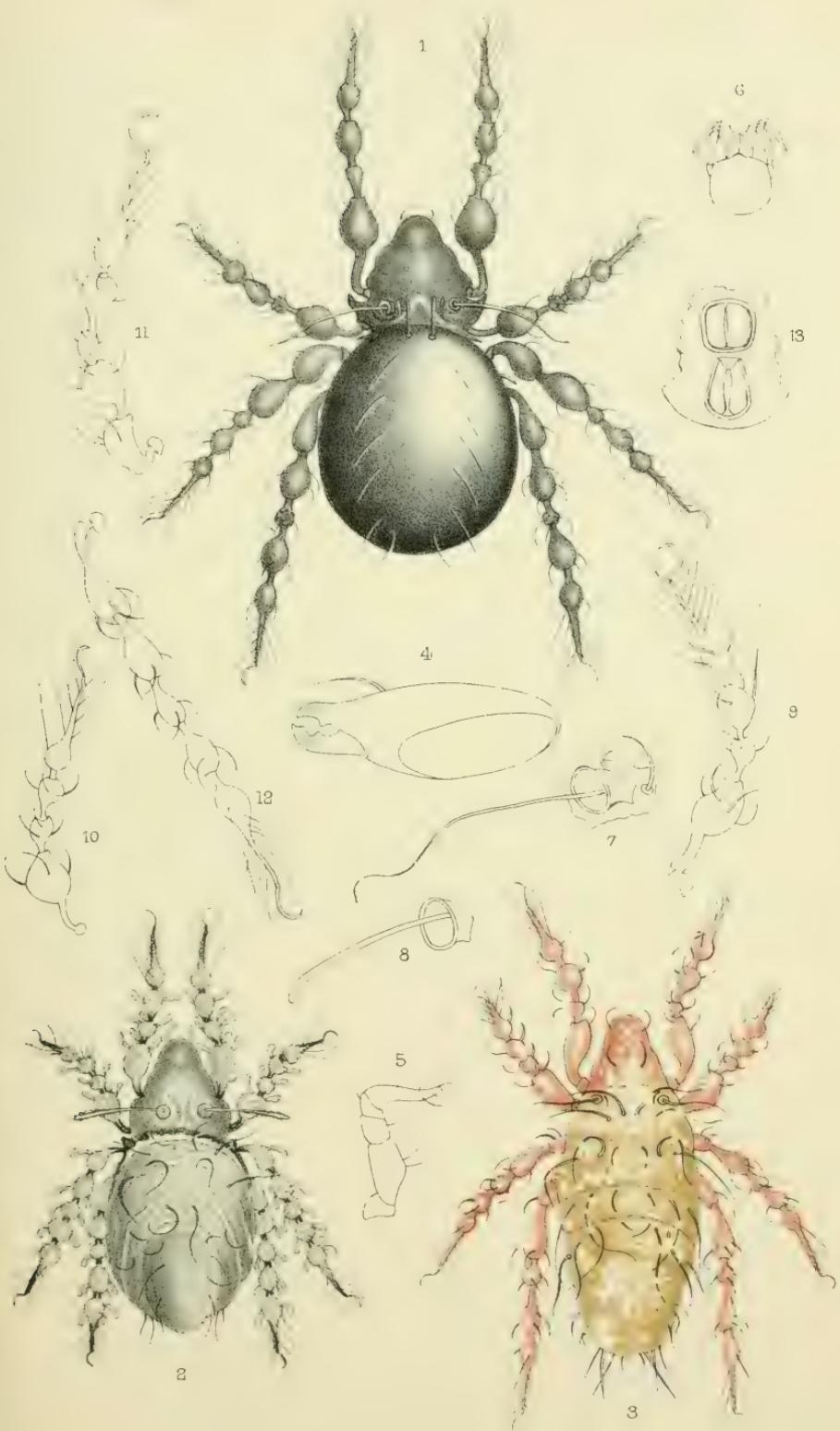


## PLATE XXXVII.

DAMÆUS VERTICILIPES. (Page 412.)

Length about .36 mm.

- Fig. 1. Adult.  $\times 100$ . From a large clean specimen without any cast skins.
2. Adult.  $\times 85$ . From a small specimen carrying cast notogastral larval and nymphal skins, and covered with the white powder.
3. Nymph.
4. Adult; mandible.  $\times 380$ .
5. Adult; palpus.  $\times 380$ .
6. Adult; labial organs.  $\times 100$ .
7. Adult; pseudo-stigma and pseudo-stigmatic organs of a perfect and clean specimen.  $\times 250$ .
8. Adult; the same, to show its appearance in an old specimen when more matted up with the white powder.
9. Adult; first left leg from the inner (right) side.  
 $\times 145$ .
10. Adult; second right leg from without and below.  
 $\times 145$ .
11. Adult; third left leg from the outer (left) side.  
 $\times 145$ .
12. Adult; fourth left leg from above.  $\times 145$ .
13. Adult; genital and anal plates.  $\times 100$ .



*Damæus verticalipes.*

A.D. Michael ad nat. del.

West, Newman & Co. chn lith.





## PLATE XXXVIII.

DAMÆUS CLAVIPES. (Page 423.)

Length about 1·05 mm.

- Fig. 1. Adult.  $\times 45$ .
- 2. Nymph.
- 3. Adult; left half of maxillary lip, showing left maxilla and first two joints of palpus as seen from above.  $\times 200$ .
- 4. Adult; chela of mandible.  $\times 260$ .
- 5. Adult; palpus.  $\times 260$ .
- 6. Adult; pseudo-stigma and pseudo-stigmatic organ.  $\times 260$ .
- 7. Adult; femur of first leg.  $\times 85$ .
- 8. Adult; tibia and tarsus of fourth leg.  $\times 85$ .



Damæus clavipes.





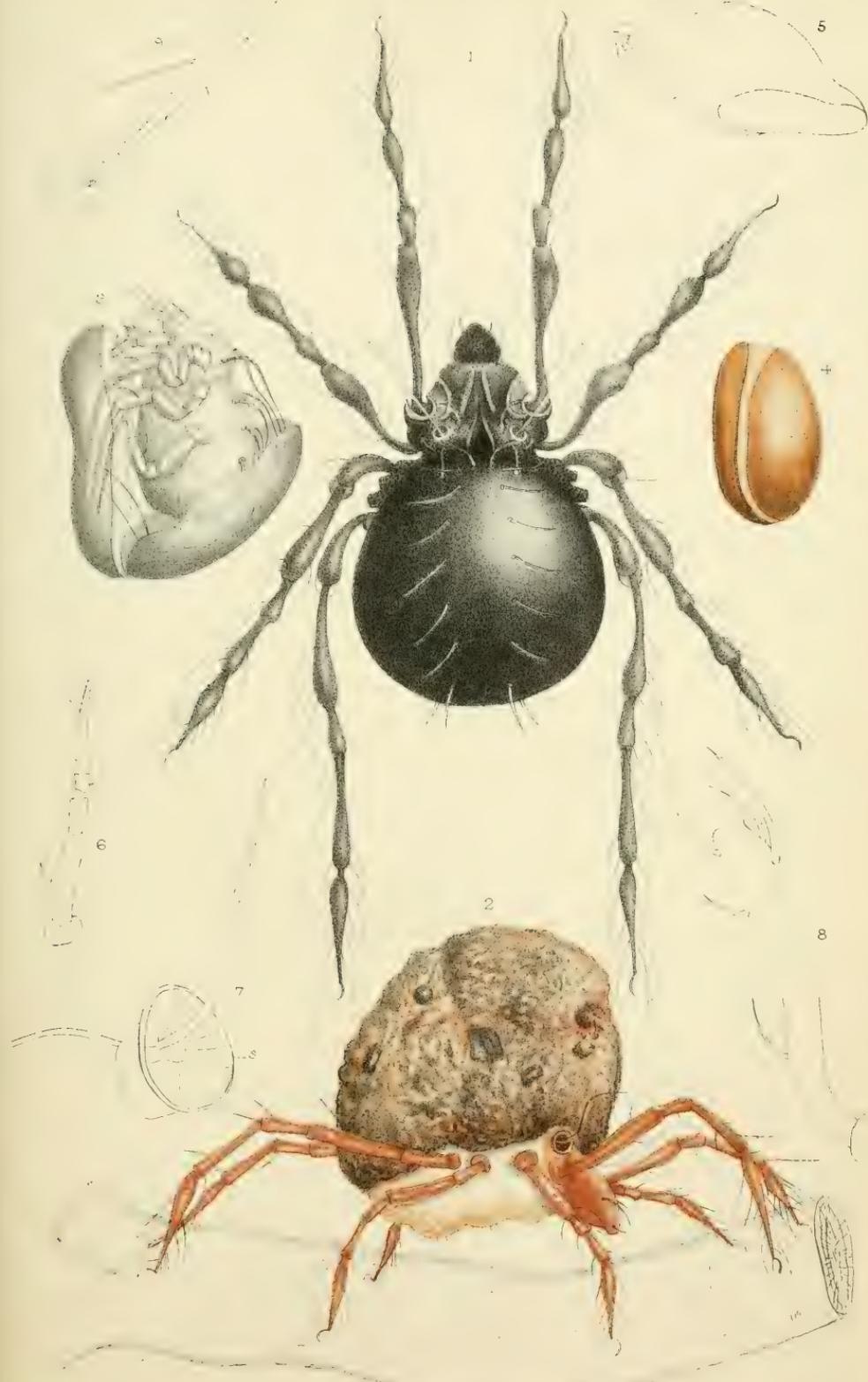
## PLATE XXXIX.

DAMÆUS GENICULATUS. (Page 428.)

Length about 1·45 mm.

- Fig. 1. Adult.  $\times 35$ .
- 2. Nymph, carrying coating of dirt, &c.
- 3. Larva in the act of escaping from the egg; showing how the long legs and hairs are packed inside the egg.
- 4. Egg during deutovium stage.
- 5. Adult; mandible.  $\times 140$ .
- 6. Adult; palpus.  $\times 140$ .
- 7. Adult; (*s*) pseudo-stigma; (*o*) pseudo-stigmatic organ.  $\times 140$ .
- 8. Adult; coxa and femur of first leg.  $\times 80$ .
- 9. Adult; tarsus of fourth leg.  $\times 80$ .

PLATE XXXIX





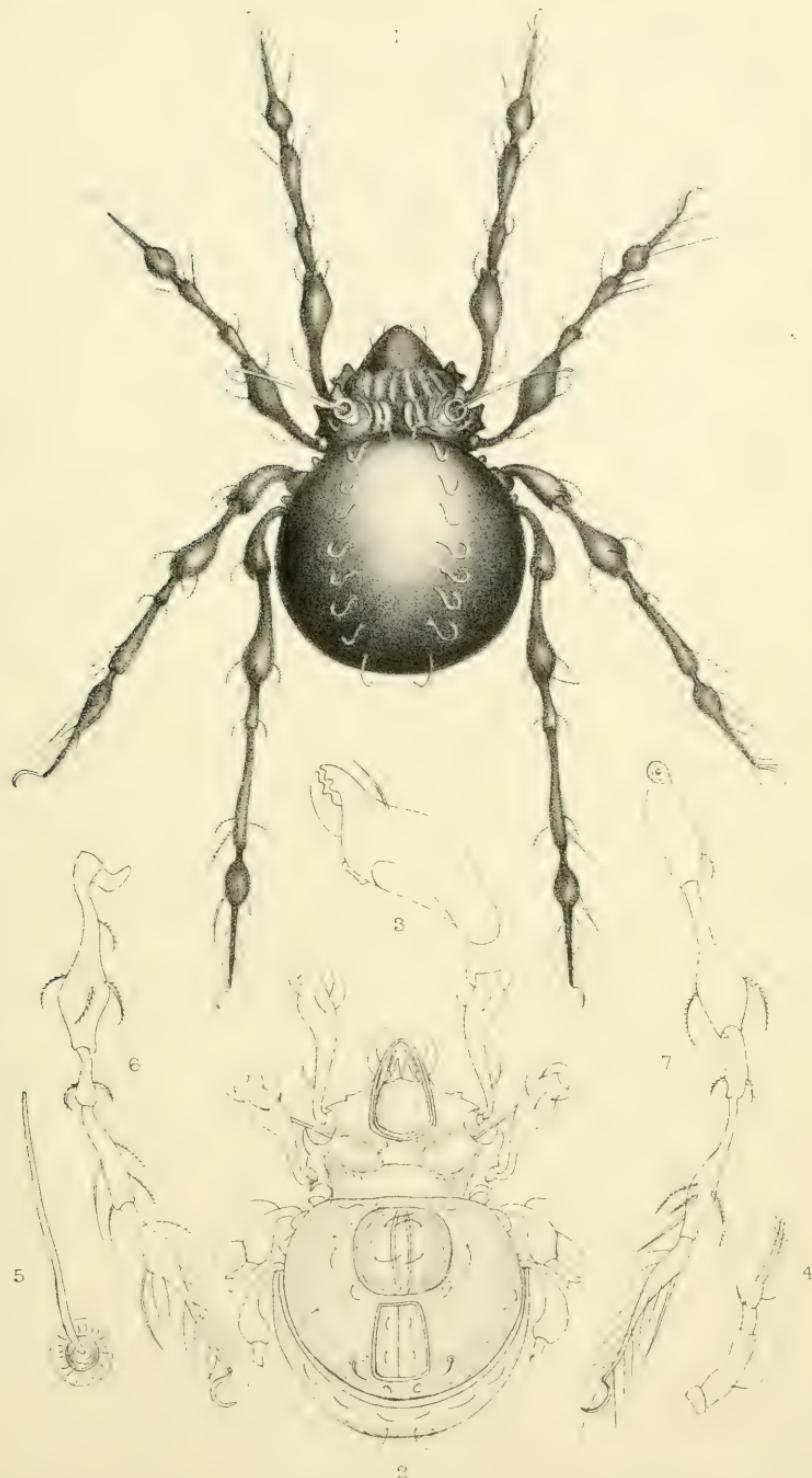


## PLATE XL.

DAMÆUS AURITUS. (Page 435.)

Length about .85 mm.

- Fig. 1. Adult.  $\times 50$ .
2. Adult; under side.  $\times 55$ .
3. Adult; right mandible from the inner (left) side.  
 $\times 150$ .
4. Adult; palpus.  $\times 180$ .
5. Adult; pseudo-stigma and pseudo-stigmatic organ.  
 $\times 180$ .
6. Adult; first leg.  $\times 80$ .
7. Adult; fourth right leg from above.  $\times 80$ .



A.D. Michael ad nat. del.

West, Newman & Co. lith.

Damæus auritus.





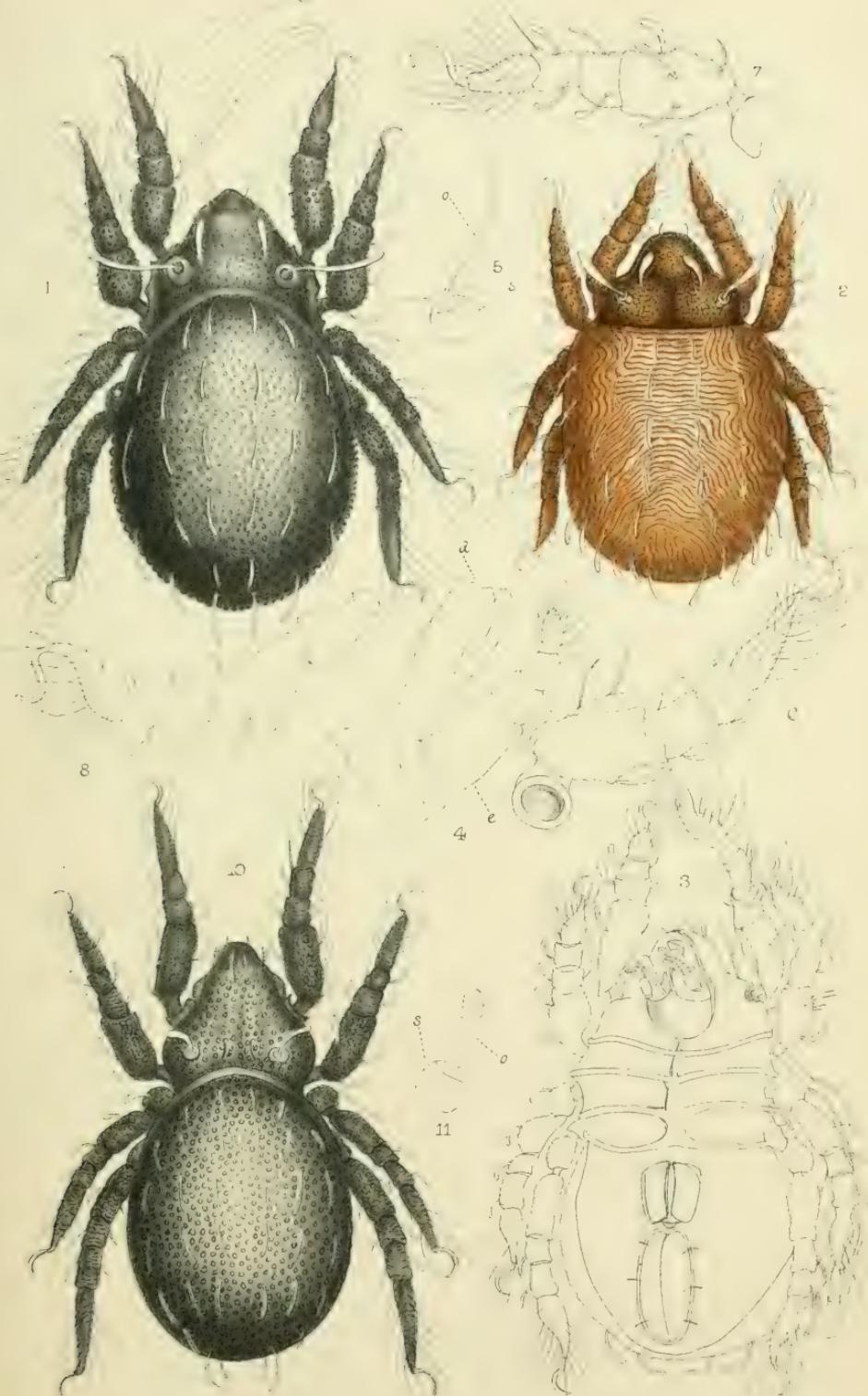
## PLATE XLI.

*HERMANNIA PICEA*. (Page 448.)  
Length about .82 mm.

- Fig. 1. Adult.  $\times 65$ .
- 2. Nymph.
- 3. Adult; under side; three quarter view to show projection of mouth-organs, roundness of form, &c. The genital plates are partly open.  $\times 65$ . (Drawn from a slightly larger specimen than Fig. 1.)
- 4. Adult; (*d*) right maxilla; (*e*) right palpus.  $\times 300$ .
- 5. Adult; (*s*) pseudo-stigma; (*o*) pseudo-stigmatic organ.  $\times 180$ .
- 6. Adult; first left leg seen from the inner (right) side.  $\times 100$ .
- 7. Adult; second right leg seen from the inner (left) side.  $\times 100$ .
- 8. Adult; fourth right leg seen from the inner (left) side.  $\times 100$ .
- 9. Adult; two of the hairs from the legs.  $\times 300$ .

*HERMANNIA NODOSA*. (Page 452.)  
Length about .87 mm.

- 10. Adult.  $\times 65$ .
- 11. Adult; (*s*) pseudo-stigma; (*o*) pseudo-stigmatic organ.  $\times 180$ .



A.D. Michael, ad nat. del.

Hermannia picea. I. ♀.  
" nodosa. II. ♂.

West, Newman & C° chrom. lith.





## PLATE XLII.

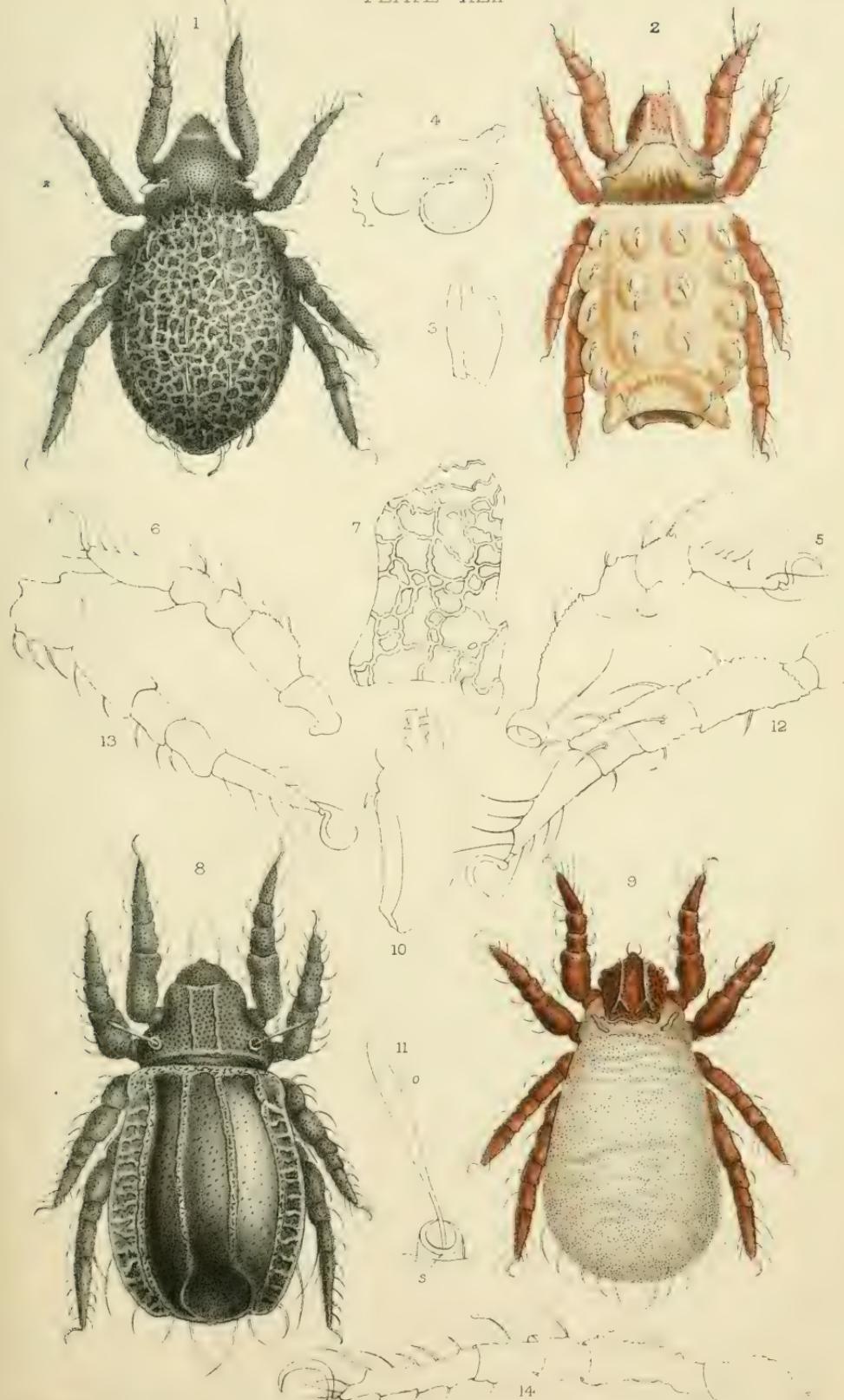
*HERMANNIA RETICULATA*. (Page 458.)  
Length about .85 mm.

- Fig. 1. Adult.  $\times 60$ .  
2. Nymph.  
3. Adult; maxilla.  $\times 400$ .  
4. Adult; pseudo-stigma and pseudo-stigmatic organ.  
 $\times 400$ .  
5. Adult; first left leg seen from the right (inner) side.  $\times 125$ .  
6. Adult; third right leg from the right (outer) side.  
 $\times 125$ .  
7. A portion of the notogaster showing the reticulation.  $\times 125$ .

*HERMANNIA BISTRIATA*. (Page 462.)  
Length about .85 mm.

8. Adult.  $\times 65$ .  
9. Nymph.  
10. Adult; mandible.  $\times 200$ .  
11. Adult; (*s*) pseudo-stigma; (*o*) pseudo-stigmatic organ.  $\times 300$ .  
12. Adult; first left leg seen from the left (outer) side.  $\times 150$ .  
13. Adult; third left leg seen from the right (inner) side.  $\times 150$ .  
14. Adult; fourth left leg seen from the right (inner) side.  $\times 150$ .

PLATE XLII



AD Michael ad nat del

Hermannia reticulata 1-7.  
bistriata 8-14.

West, Newman & C° chromo lith





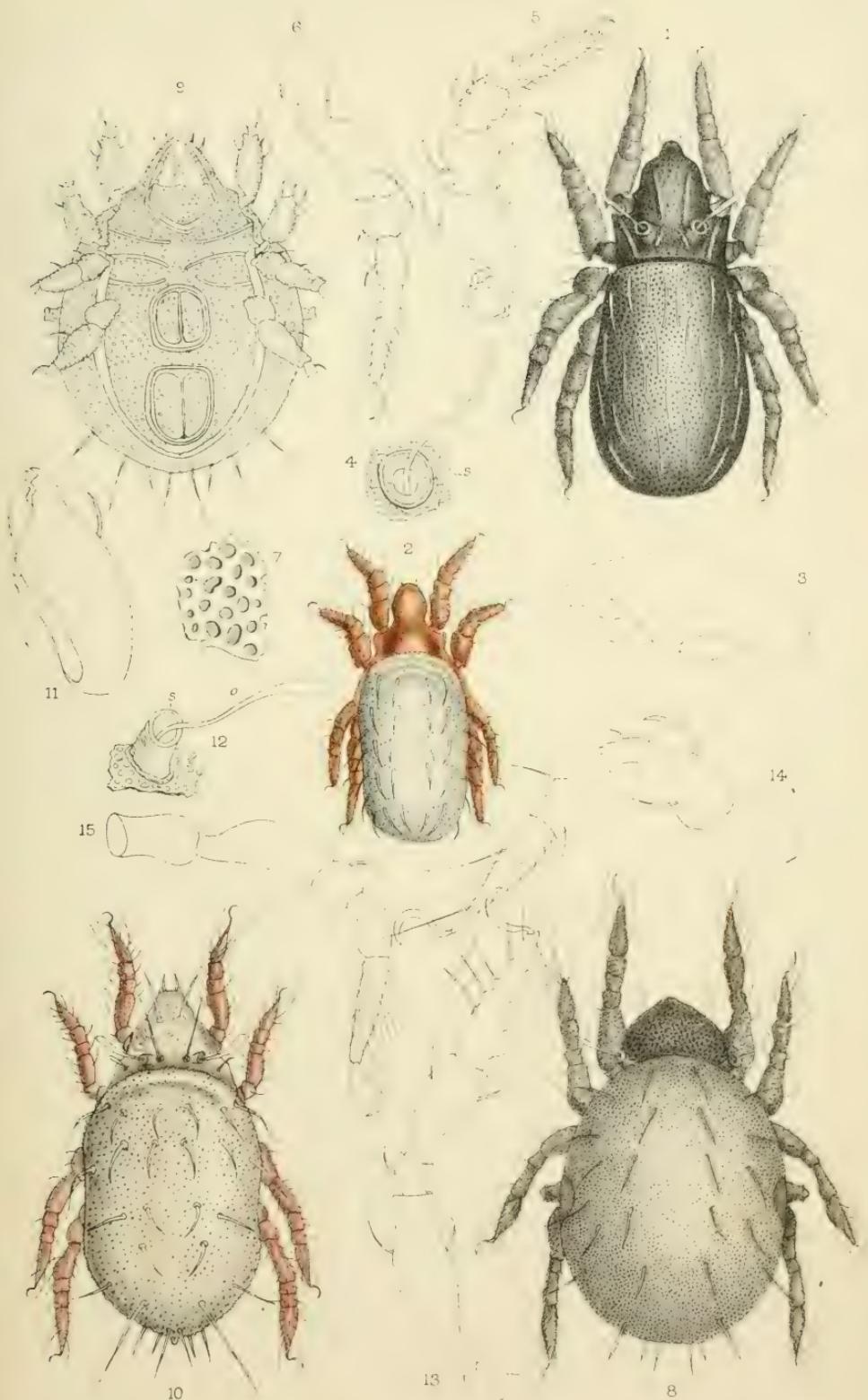
## PLATE XLIII.

*HERMANNIA NANUS.* (Page 455.)  
Length about .51 mm.

- Fig. 1. Adult.  $\times$  85.
2. Nymph.
3. Adult; mandible.  $\times$  300.
4. Adult; (*s*) pseudo-stigma; (*o*) pseudo-stigmatic organ.  $\times$  300.
5. Adult; first left leg from the inner (right) side.  $\times$  170.
6. Adult; third left leg from above.  $\times$  170.
7. Adult; a portion of the chitin of the notogaster to show the areolation.  $\times$  300.

*HERMANNIA ARRECTA.* (Page 445.)  
Length about .72 mm.

8. Adult.  $\times$  60.
9. Adult; under side.  $\times$  60.
10. Nymph.
11. Adult; mandible.  $\times$  180.
12. Adult; (*s*) pseudo-stigma; (*o*) pseudo-stigmatic organ.  $\times$  180.
13. Adult; left first leg from the inner (right) side.  $\times$  180.
14. Adult; right third leg from without.  $\times$  180.
15. Adult; left fourth leg from without.  $\times$  180.







## PLATE XLIV.

*EREMÆUS CYMBA.* (Page 470.)

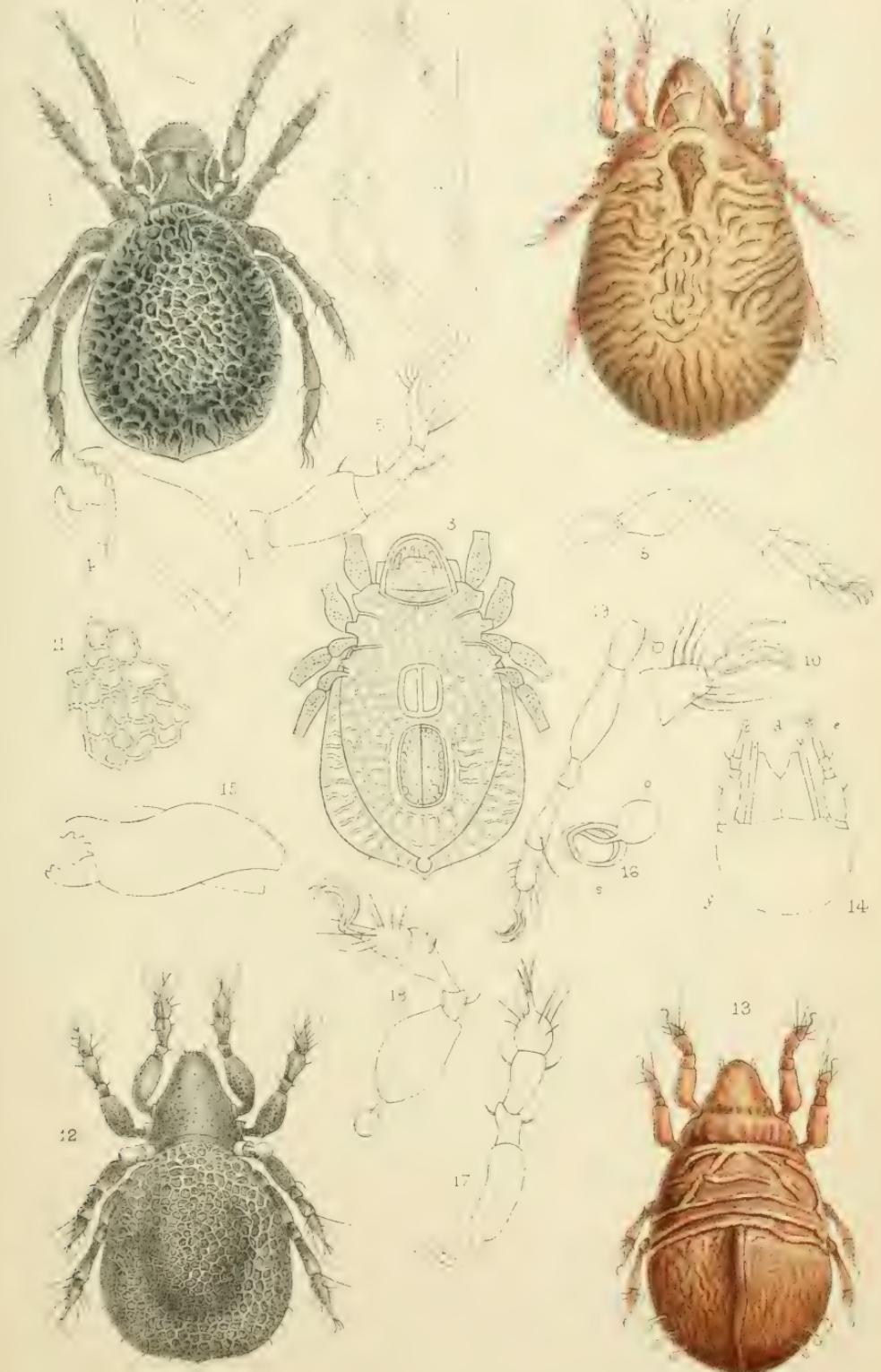
Length about .70 mm.

- Fig. 1. Adult.  $\times 65$ .
2. Nymph.
3. Adult; under side.  $\times 65$ .
4. Adult; mandible.  $\times 130$ .
5. Adult; right palpus.  $\times 300$ .
6. Adult; (s) pseudo-stigma; (o) pseudo-stigmatic organ.  $\times 400$ .
7. Adult; leg of the first pair seen from the side.  $\times 125$ .
8. Adult; third left leg seen from the left (outer) side.  $\times 125$ .
9. Adult; fourth right leg seen from the left (inner) side.  $\times 125$ .
10. Adult; one of the claws.  $\times 400$ .
11. Adult; a portion of the reticulation of the noto-gaster.  $\times 150$ .

*EREMÆUS BREVIPES.* (Page 475.)

Length about .29 mm.

12. Adult.  $\times 150$ .
13. Nymph.
14. Adult; labial organs from below.  $\times 400$ . (d) maxilla; (e) palpus; (f) labium.
15. Adult; mandible.  $\times 400$ .
16. Adult; (s) pseudo-stigma; (o) pseudo-stigmatic organ.  $\times 600$ .
17. Adult; first right leg, from above.  $\times 300$ .
18. Adult; the same leg, side view.  $\times 300$ .
19. Adult; fourth left leg, from above.  $\times 300$ .







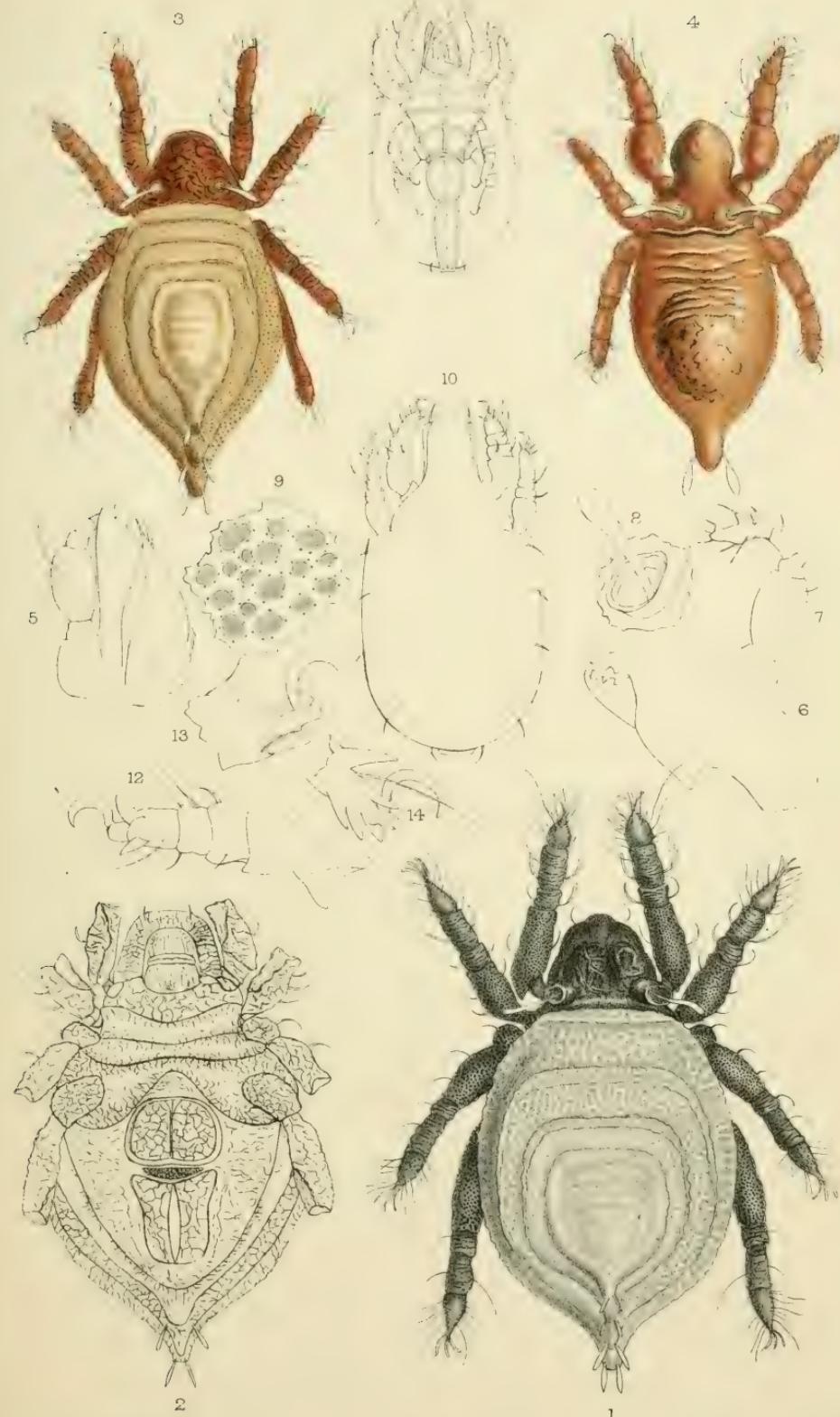
## PLATE XLV.

*NOTHRUS THELEPROCTUS.* (Page 521.)  
Length about 1·1 mm.

- Fig. 1. Adult.  $\times 50$ .  
2. Adult; under side.  $\times 50$ .  
3. Nymph.  
4. Larva.  
5. Adult; left half of the labial organs from above.  
 $\times 160$ .  
6. Adult; mandible.  $\times 160$ .  
7. Adult; palpus.  $\times 160$ .  
8. Adult; (*s*) pseudo-stigma; (*o*) pseudo-stigmatic  
organ.  $\times 160$ .  
9. Adult; a portion of the chitin of the notogaster,  
to show the reticulation.  $\times 140$ .

*NOTHRUS MONODACTYLUS.* (Page 528.)  
Length about ·29 mm.

10. Outline of adult.  $\times 120$ .  
11. Adult; under side.  $\times 100$ .  
12. Adult; first leg.  $\times 350$ .  
13. Adult; distal end of first tarsus.  $\times 750$ .  
14. Adult; distal end of fourth tarsus.  $\times 750$ .



A D Michael ad nat del.

West, Newman &amp; C° chromo lith.

Nothrus theleproctus. 1-9.  
" monodactylus. 10-14.





## PLATE XLVI.

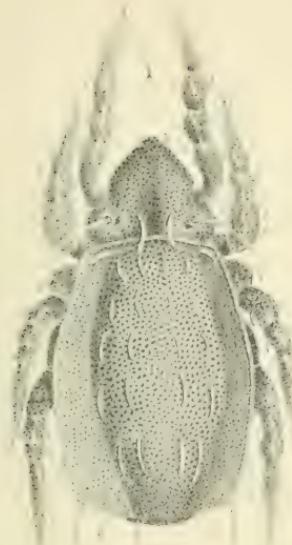
*NOTHRUS SYLVESTRIS.* (Page 490.)  
Length about .66 mm.

- Fig. 1. Adult.  $\times$  75.
- 2. Nymph.
- 3. Adult; (*d*) maxilla; (*e*) palpus.  $\times$  260.
- 4. Adult; (*s*) pseudo-stigma; (*o*) pseudo-stigmatic organ.  $\times$  260.
- 5. Adult; leg of the first pair.  $\times$  100.
- 6. Adult; leg of the third pair.  $\times$  100.
- 7. Adult; leg of the fourth pair.  $\times$  100.

*NOTHRUS PALUSTRIS.* (Page 494.)  
Length about 1.05 mm.

- 8. Adult.  $\times$  50.
- 9. Nymph.
- 10. Adult; left mandible from below and within (right side).  $\times$  180.
- 11. Adult; pseudo-stigma and pseudo-stigmatic organ.  $\times$  180.
- 12. Adult; leg of the first pair.  $\times$  80.
- 13. Adult; leg of the third pair.  $\times$  80.

PLATE XLVI







## PLATE XLVII.

NOTHRUS HORRIDUS. (Page 503.)

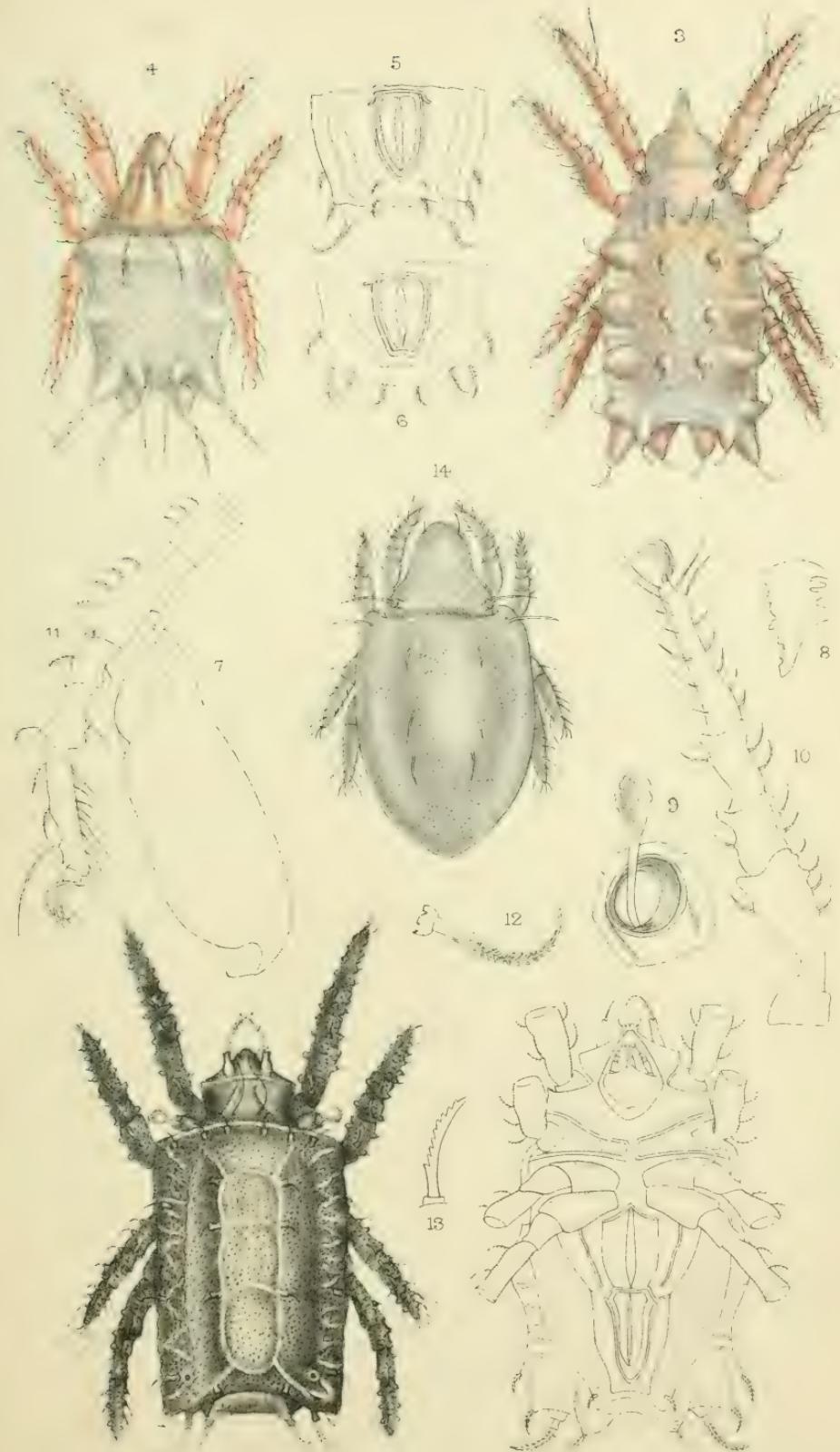
Length about .80 mm.

- Fig. 1. Adult.  $\times 65$ .  
2. Adult; under side.  $\times 70$ .  
3. Nymph.  
4. Larva.  
5. Under-side of the hinder part of the abdomen  
of *H. bicarinata* (for comparison).  
6. Under side of the hinder part of the abdomen  
of *H. invenustus* (for comparison).  
7. Adult; mandible.  $\times 300$ .  
8. Adult; distal end of maxilla.  $\times 300$ .  
9. Adult; pseudo-stigma and pseudo-stigmatic  
organ.  $\times 400$ .  
10. Adult; 1st right leg.  $\times 145$ .  
11. Adult; 4th left leg.  $\times 145$ .  
12. One of the hairs from the hind margin of the  
abdomen.  $\times 150$ .  
13. One of the hairs from the outside of the front  
leg.  $\times 300$ .

NOTHRUS TARDUS. (Page 526.)

Length about .36 mm.

14. Adult.  $\times 120$ .



A D Michael ad nat del

Nothrus horridus  
tardus

West, Newman &amp; Co chrom lith.





## PLATE XLVII A.

**NOTHRUS BICARINATUS.** (Page 514.) Length about .75 mm.

Fig. 1. Adult.  $\times$  65.

2. Adult; chela of mandible.  $\times$  400.
3. Adult; rostrum from above.  $\times$  145.
4. Adult; pseudo-stigma and pseudo-stigmatic organ.  $\times$  400.
5. Adult; 4th leg.  $\times$  145.

**NOTHRUS BIVERRUCATUS.** (Page 510.) Length about .1 mm.

6. Adult.  $\times$  55.

7. Adult; right mandible from without.  $\times$  180.

8. Adult; pseudo-stigma and pseudo-stigmatic organ,  $\times$  400. These include the portions within the body seen in optical, longitudinal, median section; (*o*) external pseudo-stigmatic organ; (*o<sup>1</sup>*) portion of peduncle of same within the body; (*s*) external pseudo-stigma; (*s<sup>1</sup>*) portion of same within the body; (*ch*) section of the chitinous cuticle of the cephalothorax; (*nf*) nerve.

9. Adult; central portion of the posterior margin of the abdomen.  $\times$  180.

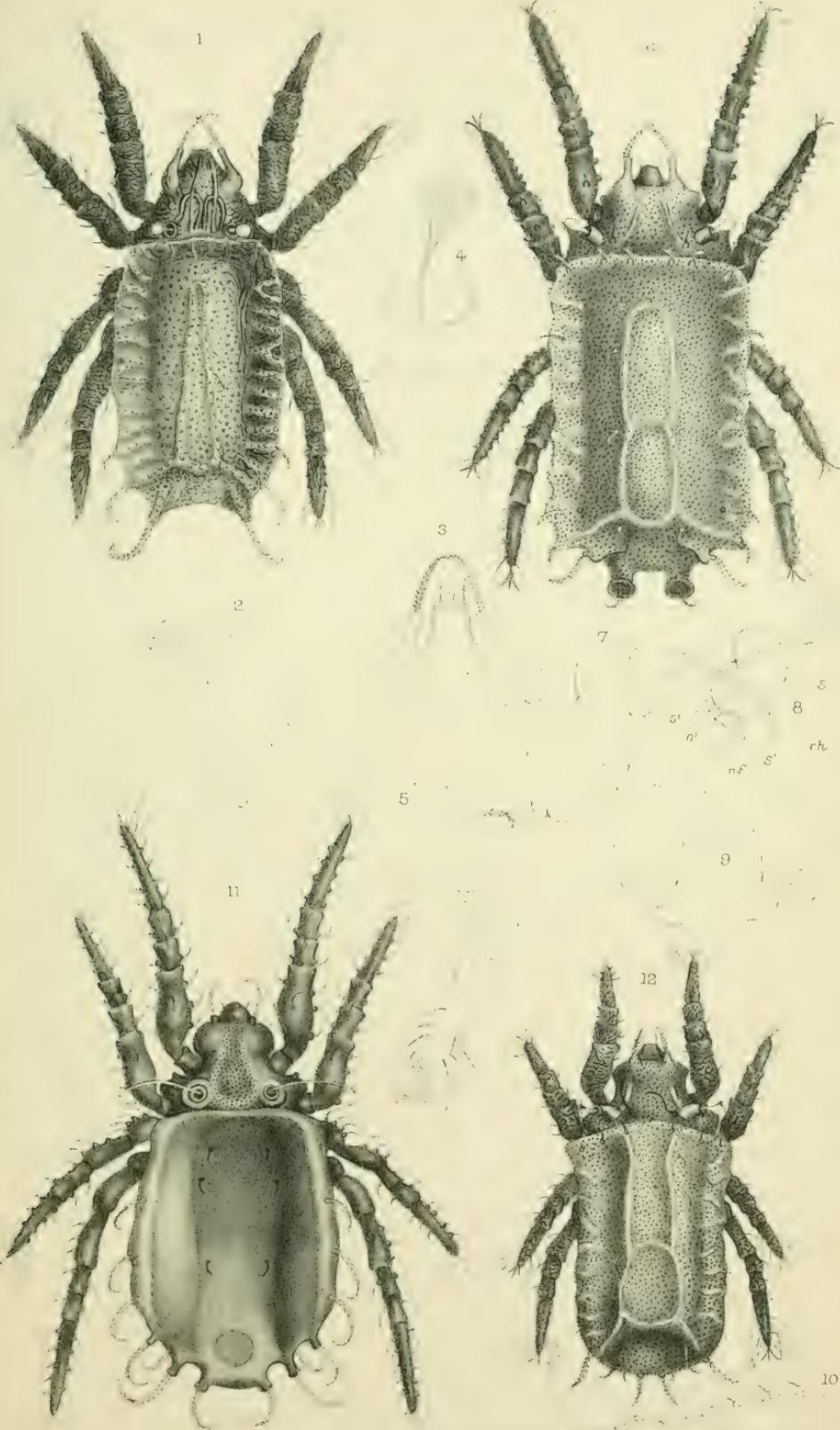
10. Adult; 2nd leg from within.  $\times$  100.

**NOTHRUS TARGIONII.** (Page 488.) Length about .83 mm.

11. Adult.  $\times$  65.

**NOTHRUS INVENUSTUS.** (Page 500.) Length about .66 mm.

12. Adult.  $\times$  65.







## PLATE XLVIII.

*NOTHRUS SEGNIS.* (Page 517.)

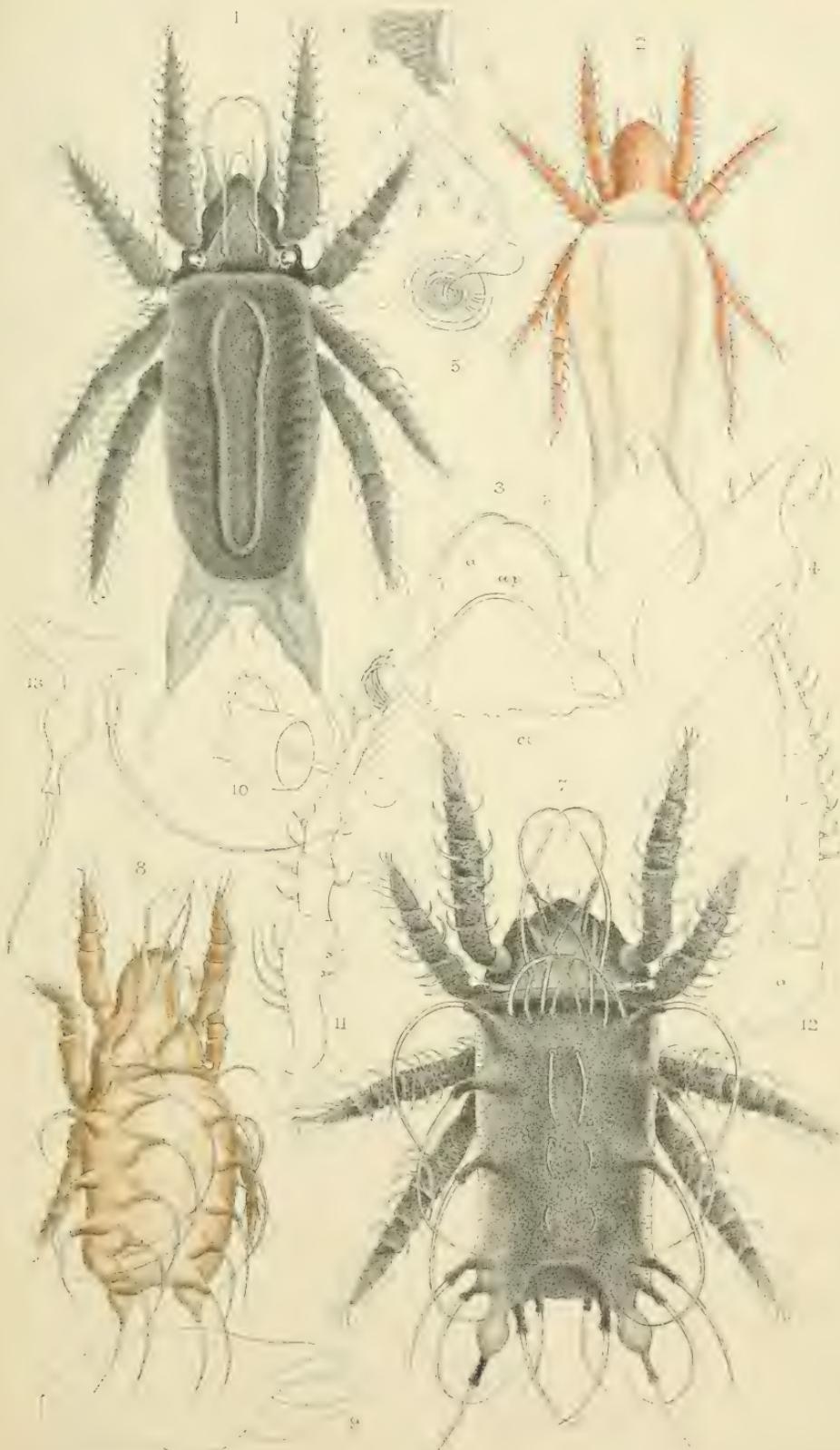
Length about .85 mm.

- Fig. 1. Adult.  $\times 70$ . The skin of the posterior projection of the nymph, and a small strip of the skin from the lateral margin of the nymphal abdomen, is carried by the adult on each side. The hairs on the abdomen are omitted in the drawing.
2. Nymph.
3. Adult; rostrum and camerastomum from below.  $\times 125$ . (a) epistome; (co) camerastomum; (b) rostral hair; (ap) apophysis carrying same.
4. Adult; left mandible seen from the right (inner) side and slightly below.  $\times 260$ .
5. Adult; pseudo-stigma and pseudo-stigmatic organ.  $\times 260$ .
6. Adult; half of the posterior margin of abdomen, as seen by transmitted light.  $\times 85$ . (a) body of adult seen through the nymphal skin; (b) apophysis at postero-lateral angle; (c) small branch from inner side of same, carrying (d) a large spatulate hair; (e) cast skin of posterior margin of nymph; (p) cast skin of the great posterior projection of the abdomen of the nymph; (g) apophysis of same; (h) spatulate hair carried thereby; (i) strip of nymphal cast skin adhering to the lateral edge of the abdomen of the adult.

*NOTHRUS SPINIGER.* (Page 497.)

Length about .84 mm.

- Fig. 7. Adult.  $\times 60$ .
8. Larva; three-quarter view.
9. Adult; right mandible seen from the left (inner) side.  $\times 250$ .
10. Adult; pseudo-stigma and pseudo-stigmatic organ.  $\times 250$ .
11. Adult; leg, first pair.  $\times 85$ .
12. Adult; leg, 4th pair.  $\times 85$ . (a) epimeron.
13. Adult; apophysis and spines at left posterior angle of abdomen.  $\times 85$ .







## PLATE XLIX.

### HYPOCTHONIUS PALIDULUS. (Page 537.)

Length about .36 mm.

- Fig. 1. Adult.  $\times 140$ .
2. Nymph.
3. Adult. (*s*) pseudo-stigma; (*o*) pseudo-stigmatic organ.  $\times 400$ .
4. Adult; first left leg from above.  $\times 300$ .
5. Adult; fourth right leg from without and below.  $\times 300$ .

### HYPOCTHONIUS RUFULUS. (Page 534.)

Length about .58 mm.

6. Adult.  $\times 80$ .
7. Adult; under side.  $\times 65$ .
8. Egg, dissected out of the body of the adult; showing the state of segmentation considerably advanced.  $\times 75$ .
9. Adult; mandible.  $\times 275$ .
10. Adult; palpus.  $\times 275$ .
11. Adult; (*s*) pseudo-stigma; (*o*) pseudo-stigmatic organ.  $\times 275$ .
12. Adult; first left leg from above.  $\times 145$ .
13. Adult; fourth left leg from above.  $\times 145$ .

### HYPOCTHONIUS BREVIS. (Page 539.)

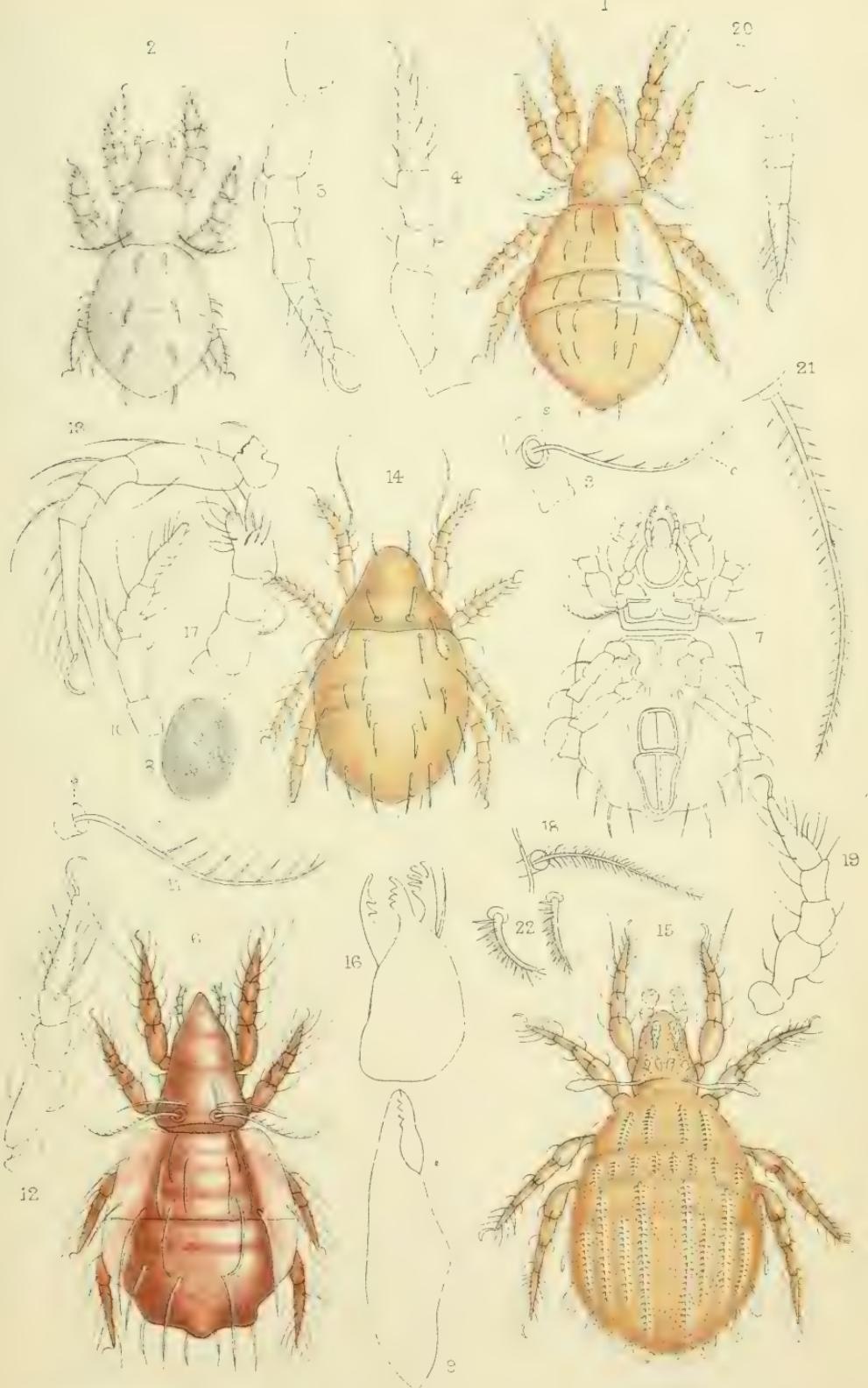
Length about .18 mm.

14. Adult.  $\times 200$ .

### HYPOCTHONIUS LANATUS. (Page 541.)

Length about .33 mm.

15. Adult.  $\times 140$ .
16. Adult; mandible.  $\times 800$ .
17. Adult; palpus.  $\times 450$ .
18. Adult; pseudo-stigma and pseudo-stigmatic organ.  $\times 450$ .
19. Adult; first leg.  $\times 250$ .
20. Adult; fourth leg.  $\times 250$ .
21. Adult; one of the large hairs from the notogaster.  $\times 450$ .
22. Adult; two of the short woolly hairs from the hind margin of the abdomen.  $\times 450$ .







## PLATE L.

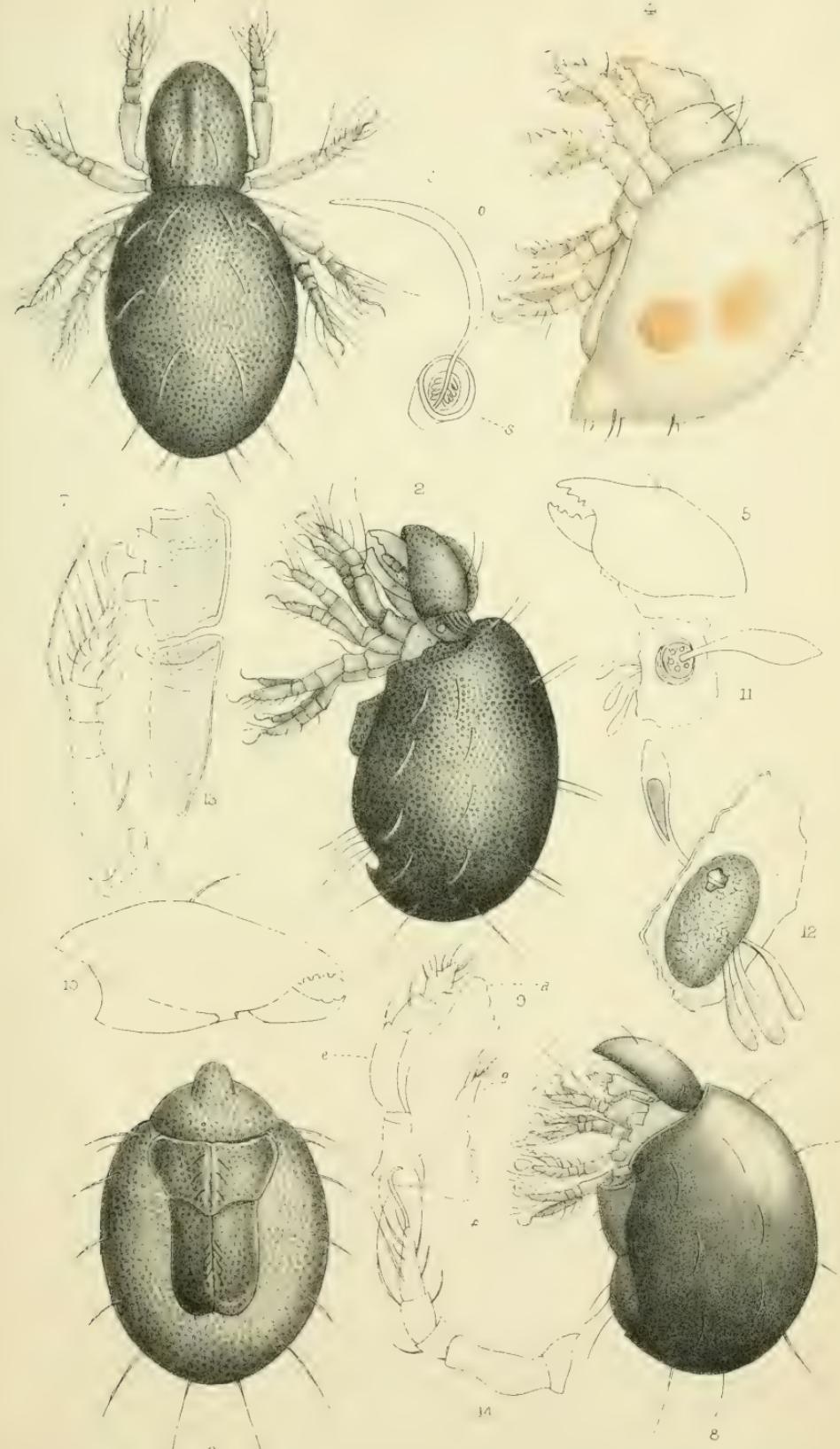
HOPLOPHORA MAGNA (see also Pl. LI.) (Page 556.)

Length from about .90 to about 1.30 mm.

- Fig. 1. Adult; extended, dorsal aspect.  $\times 45$ .
2. Adult; extended, side view.  $\times 45$ .
3. Adult; closed, ventral aspect.  $\times 45$ .
4. Nymph.
5. Adult; mandible.  $\times 100$ .
6. Adult; (s) pseudo-stigma, and (o) pseudo-stigmatic organ.  $\times 300$ .
7. Adult; leg, 1st pair.  $\times 100$ .

HOPLOPHORA DASYPUS. (Page 560.) Length from .5 to 1.30 mm.

8. Adult; side-view.  $\times 50$ . This is drawn from a large specimen.
9. Adult; left half of the labial organs from above.  $\times 150$ . (d) maxilla; (e) palpus; (f) labium; (g) end of ligula.
10. Adult; left mandible from within and below.  $\times 150$ .
11. Adult; pseudo-stigma and pseudo-stigmatic organ, and the three small air-sacs, from without.  $\times 500$ .
12. Adult; the same from within.  $\times 500$ . The capsule in the interior of the body is drawn, as having a hole broken in it so as to show where the peduncle of the pseudo-stigmatic organ is situated.
13. Adult; right genital and anal plates, and two genital suckers from within (above).  $\times 80$ .
14. Adult; 1st left leg from the inner (right) side.  $\times 140$ .







## PLATE LI.

HOPLOPHORA MAGNA. (Page 556.) (See also Pl. L.)

Fig. 1. Adult; somewhat diagrammatic view of the left genital and anal plates and surrounding parts seen from above (within the body); (*g. p.*) genital plate; (*an.*) anal plate; (*d. p.*) part of the dorsal plate; (*l. p.*) part of the lateral plate ankylosed to the dorsal plate, and representing the acropleuron and basipleuron; (*v. p.*) vestigial ventral plate ankylosed to the anal plate; (*ex.*) expulsive vesicle.

2 *a*, 2 *b*, 2 *c*, 2 *d*, 2 *e*, 2 *f*, 2 *g*. Eggs in progressive stages of development, and in various positions, dissected out of the oviducts of the female. All  $\times 100$ . 2 *g* is the highest state of maturity attained within the body of the mother.

3. Young hexopod larva lately emerged from the egg.  $\times 100$ . The abdomen has not yet attained its proper shape.

4. The egg-shell from which it has escaped.  $\times 100$ .

HOPLOPHORA ANOMALA. (Page 558.) Length from about .75 to about 1.60 mm.

5. Adult; extended, and with genital and anal plates open, and genital suckers protruded; side-view.  $\times 50$ .

6. Adult; nearly closed up; side-view.  $\times 50$ .

HOPLOPHORA STRICULA. (Page 563.) Length about .52 mm.

7. Adult; from above.  $\times 85$ .

HOPLOPHORA ARDUA. (Page 564.) Length about 80 mm.

8. Adult; from the side.  $\times 75$ .

9. Adult; left maxilla and palpus from above.  $\times 200$ .

10. Adult; right mandible from the inner (left) side.  $\times 180$ .

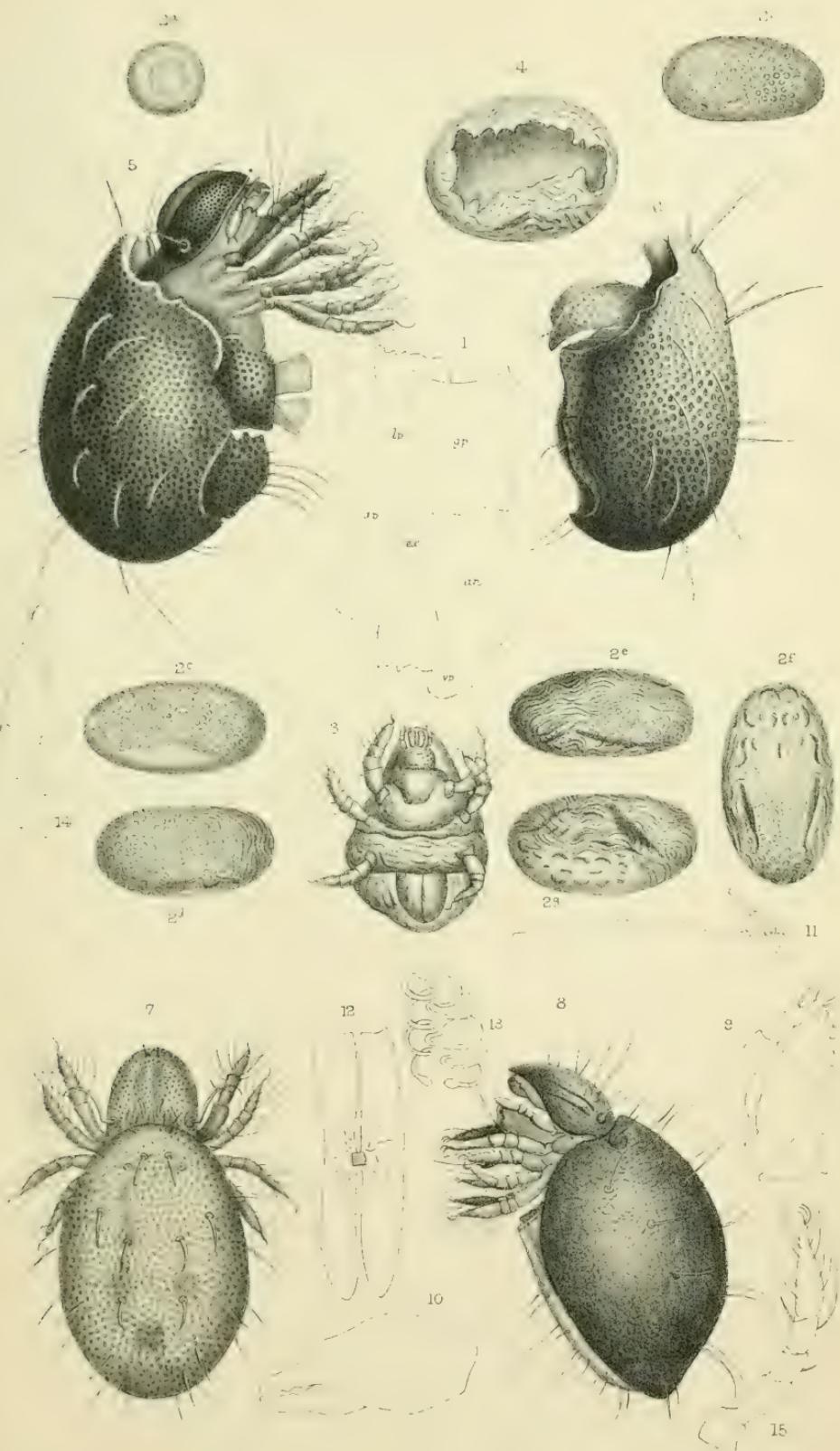
11. Adult; pseudo-stigma and pseudo-stigmatic organ.  $\times 250$ .

12. Adult; genital and anal plates.  $\times 80$ .

13. Adult; interlocking portion of anal plates.  $\times 500$ .

14. Adult; 1st leg.  $\times 180$ .

15. Adult; 4th leg.  $\times 180$ .



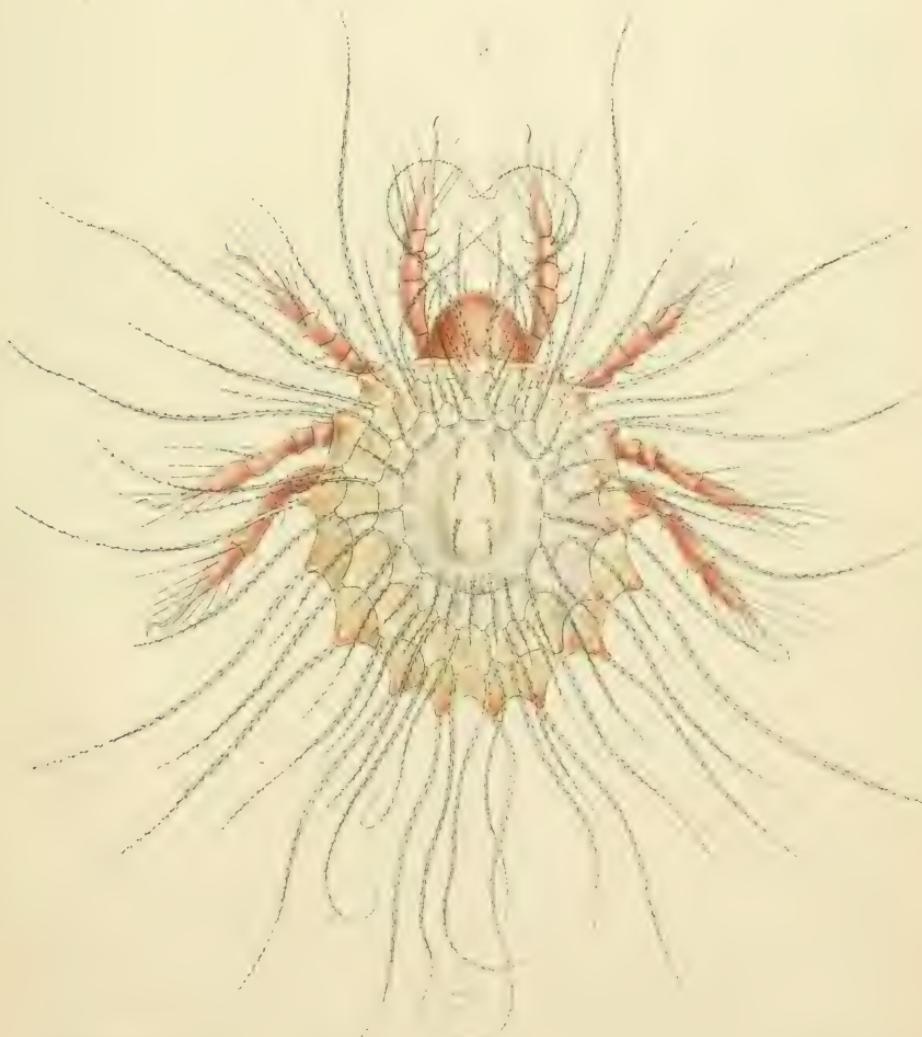
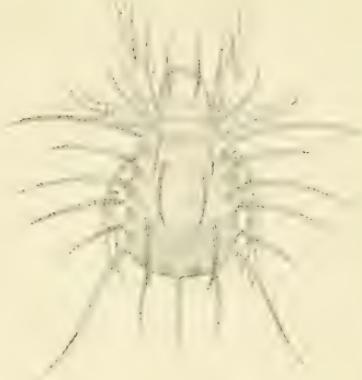




## PLATE LII.

Immature stages of species the adults whereof have  
been figured in Vol. I.

- Fig. 1. *PELOPS PHÆONOTUS*. Nymph. (Page 574.)  
2. *CEPHEUS BIFIDATUS*. Larva. (Page 577.)  
3. — — Nymph. (Page 576.)



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W. & N. Newman & Co Imp.

Immature stages of  
Pelops phœnotus and Cepheus bifidatus.

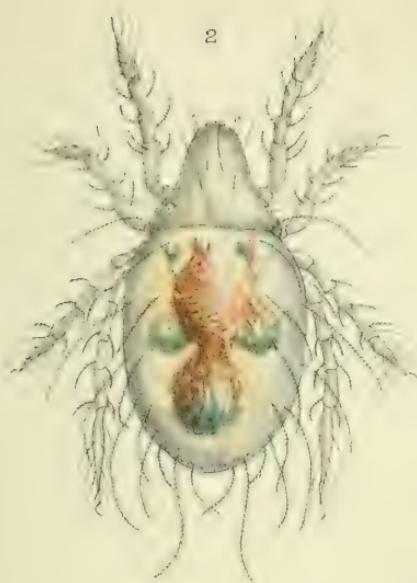




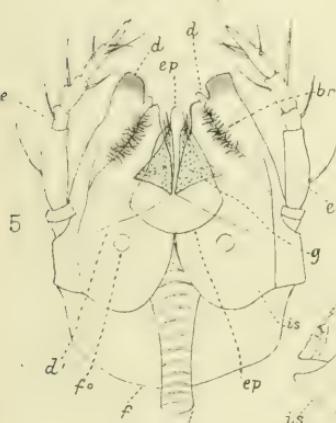
## PLATE LIII.

- Fig. 1. ORIBATA EDWARDSII. Nymph. (Page 575.)
2. Nymph referred to at p. 579; the adult whereof is not distinguishable from ORIBATA CUSPIDATA.
3. DAMÆUS CLAVIPES. Larva. (Page 426.)
4. Immature reproductive organs of the fully-grown nymph of *Nothrus theleproctus*.  $\times$  about 150. (ov.) ovary; (od.) oviducts; (v.) vagina; (gp.) genital plates; (m. m.) bands of muscle.
5. Labial and mouth organs (excluding the mandibles) of *Cepheus latus* seen from above.  $\times$  about 130. (d. d.) maxillæ; (d'. d') hinder edge of same; (e. e.) palpi; (f.) labium; (g.) lingua, in paired halves, as it is seen in preparations; this organ is dotted to distinguish it from other parts; it is not really dotted; (ep.) the epipharynx; (is.) thin chitinous partition forming the inner skeleton of the mouth, and supporting the epipharynx, which is beneath it; (fo.) foramen in *is.*; (br.) brush bordering the upper edge of each maxilla; (œ.) œsophagus.
6. The same seen from the side. This figure is diagrammatic. Same lettering as Fig. 5 (the labium is seen in section; the maxillæ are cut away).
7. Lingua of same.
8. Epipharynx of same.
9. Lingua and section of labium of *Oribata lapidaria*.  $\times$  about 200.
10. Diagram of the arrangement of the anal plates and ovary of female *Notaspis lucorum*. (ap.) anal plates; (ov.) ovary; (od.) oviducts; (st.) chitinous piece within the body above the anal plates; (sd.) sperm-duct (supposed); (vp.) ventral plate.
11. Brain (supra-œsophageal ganglion) and smaller lateral ganglia of *Oribata globula*.

2



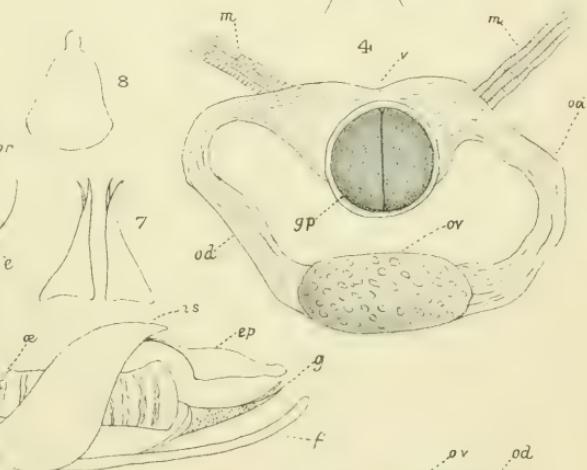
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8



6



9



11



3







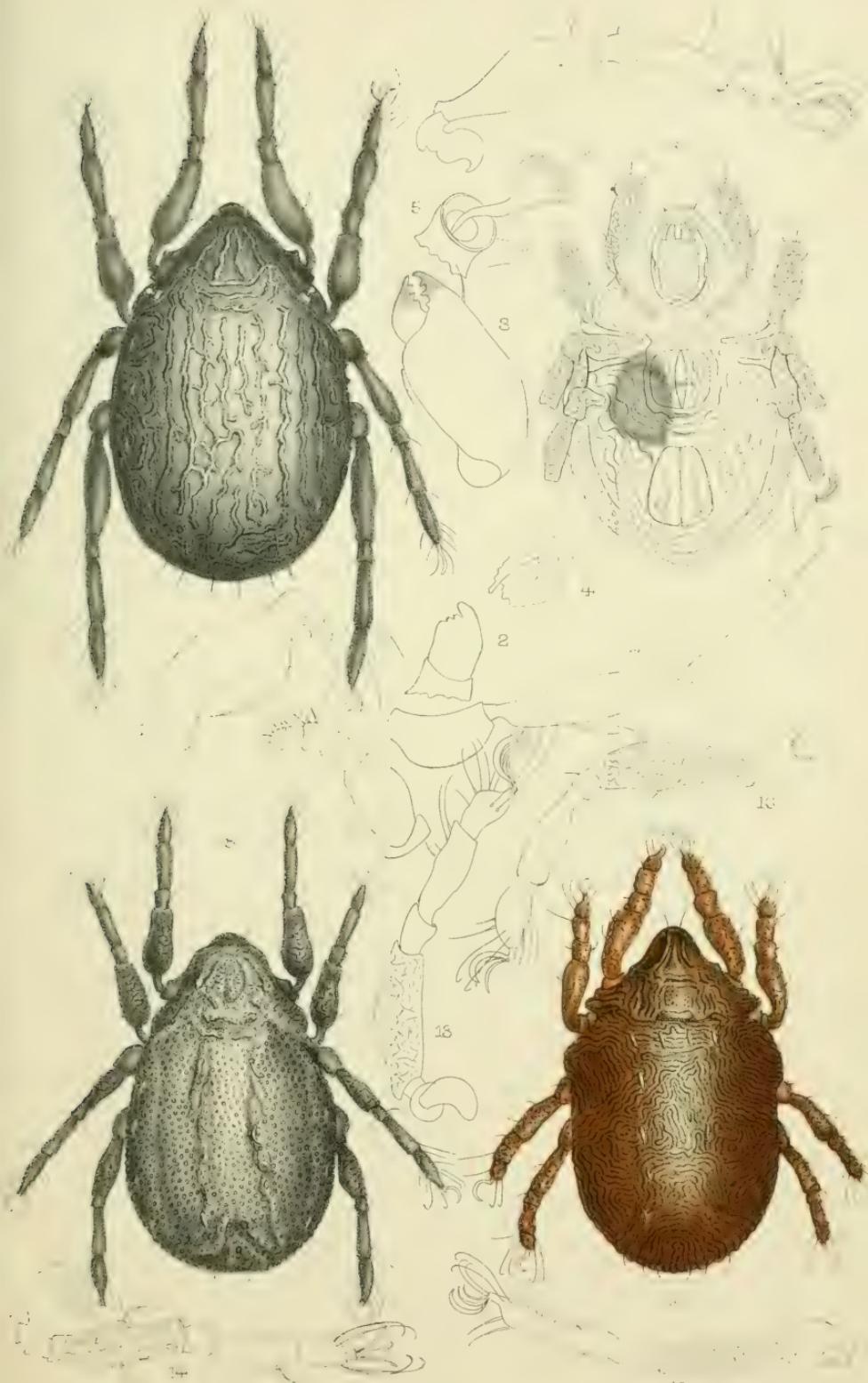
## PLATE LIV.

*SCUTOVERTEX CORRUGATUS.* (Page 567.) Length about .68 mm.

- Fig. 1. Adult.  $\times 75$ .
- 2. Adult; end of maxilla.  $\times 180$ .
- 3. Adult; mandible.  $\times 145$ .
- 4. Adult; chela of mandible.  $\times 180$ .
- 5. Adult; (s) pseudo-stigma; (o) pseudo-stigmatic organ.  $\times 180$ .
- 6. Adult; 1st left leg from the inner (right) side.  $\times 145$ .
- 7. Adult; 4th right leg from the inner (left) side.  $\times 145$ .

*SCUTOVERTEX BILINEATUS.* (Page 571.) Length about .62 mm.

- 8. Adult.  $\times 75$ .
- 9. Adult; underside  $\times 80$ ; showing the young fully formed and not enveloped in any egg-shell or membrane, although still within the body of the mother. This is drawn from an actual specimen, in order to illustrate the viviparous reproduction for which the genus is remarkable.
- 10. Nymph.
- 11. Adult; mandible.  $\times 145$ .
- 12. Adult; palpus.  $\times 380$ .
- 13. Adult; 1st left leg from the inner (right) side.  $\times 145$ .
- 14. Adult; 1st right leg from above.  $\times 145$ .
- 15. Adult; 3rd right leg from the inner (left) side.  $\times 145$ .
- 16. Adult; 4th left leg from the inner (left) side.  $\times 145$ .



A.D. Michael ad nat. c.

*Scutovertex corrugatus* 1-7" *bilineatus* 8-16.

West. Newman &amp; C° chrom. lith.

L7







